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Master Thesis

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Impact of E-mental Health: a Quantitative Analysis

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Preface

In order to complete the master course Business Mathematics and Informatics, students are expected to complete a thesis at a company. The subject of this thesis is the analysis of the impact of e-mental health. The internship was done at Minddistrict.

I would like to thank everybody who participated in this project and had a share in its successful completion. Many thanks to Ger Koole (supervisor), Dennis Moeke (second reader), Fetsje Moné-Bijma (assistant prof. statistics), Ed Kist (lean coach), the mental health and addiction care institutions that participated in this research, Mark Willems (director Minddistrict) and my other colleagues at Minddistrict. Last but certainly not least, I would like to thank my family and friends for their support.

Amsterdam, October 2011.

Abstract

The increasing demand for mental health and addiction care will lead to a serious capacity problem within mental health and addiction care institutions. These institutions have limited resources and the costs for increasing the resources are very high. E-mental health promises these institutions a cost effective solution by giving them the opportunity to do parts of the intake and mental health and addiction care process online. The institutions could handle more clients with their limited resources with the use of e-mental health.

There is much uncertainty about the impact of e-mental health on the efficiency and effectiveness of the services provided by the institutions. It is still unclear what the actual added value of e-mental health is for the institutions and their clients. There are many studies about online interventions and about effectiveness of several online interventions, but there has been no such research about the efficiency of e-mental health processes so far.

The purpose of this research is to determine the efficiency and effectiveness of e-mental health. This will be done by analyzing data from a mental health and addiction care institution, which uses e-mental health provided by Minddistrict. The analysis will be done by comparing key performance indexes (KPI's) like treatment times, number of contacts, duration, effectiveness and productivity of the e-mental treatment process with the regular treatment process.

This research shows that the treatment time per online contact was 10% less than the treatment time per f2f (face to face) contact. This difference becomes even greater when looking at the different possible types of contacts separately. The blended treatments (treatments with online and f2f contacts) needed 36% less f2f contacts than the f2f treatments, but the blended treatments needed 22% more contacts in total compared to the f2f treatments. The duration of the blended treatments was 25% longer than the duration of the f2f treatments. The effectiveness of the blended treatments was 126% higher than the effectiveness of the f2f treatments. The effectiveness is the change in GAF (Global Assessment of Functioning) score during a completed treatment program. The productivity of the therapists that treat blended was 9% higher than the productivity of the therapists that treat only f2f. The productivity is the income/costs ratio of a therapist.

These results seem very promising, but still they lack statistical uncertainty, which is mainly caused by a low number of online contacts and the bias in the data.

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1 Introduction

This chapter will give an introduction about the internship at Minddistrict by giving a brief description of the company, the motivation of the current research and the structure of this thesis.

1.1 About the company: Minddistrict

Minddistrict implements online systems to treat clients online (see Figure 1.1). Clients are individuals who need help with their addiction or mental health. The company was founded in 2008 and claims to be the leader in offering e-mental health services to mental health and addiction care institutions in the Netherlands. An important part of their services is to optimize the intake and treatment process. Their online treatment center allows clients to do much more at home compared to the regular face to face (f2f) treatment method (see Figure 1.2). This could reduce the amount of f2f contacts between the specialist and the clients. Specialists are the employees of the mental health care or addiction care institutions like psychiatrists, therapists, coaches, medics, nurses, etc. The effects are assumed to be: shorter waiting lists, shorter durations, less treatment time, fewer no-shows, lower wages and less overhead.

Figure 1.1: The e-mental health center of Minddistrict (www.minddistrict.nl) (Accessed at: 01-03-2011))

The system of Minddistrict supports the mental health care reference process model. It contains all the functionalities to do the intake and mental health care process (partially) online. These functionalities are: treatment programs, intakes, assessments, file functions, message function and treatment support functions such as journals, motivation plans, thought schemes, etc.

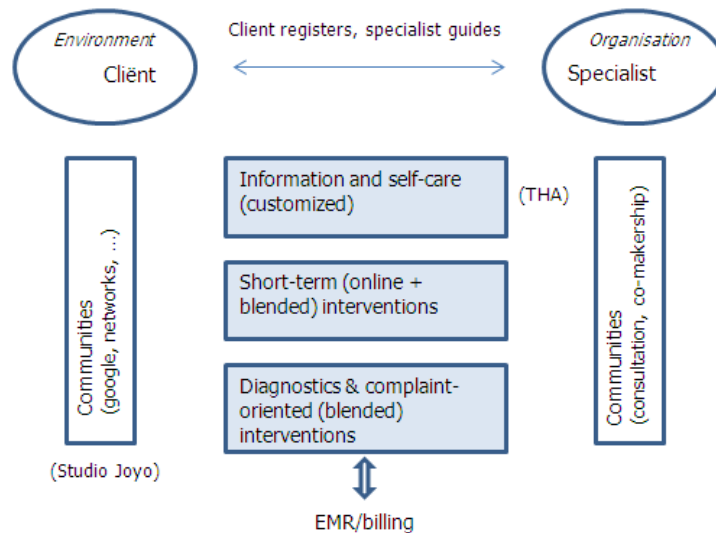


Figure 1.2: The vision of Minddistrict.

Minddistrict is an ambitious company with the intention to continue their growth abroad. They already have customers in Spain and have plans to enter the German and English market with their product. Customers of Minddistrict are mostly mental health and addiction care institutions, but could also be independent practitioners. The focus of Minddistrict will be on the development of new online interventions and improving their current online treatment center. Minddistrict works with several universities to develop courses on e-mental health, because they believe that this will be the future for mental health and addiction care. Figure 1.3 shows the organizational structure of Minddistrict.

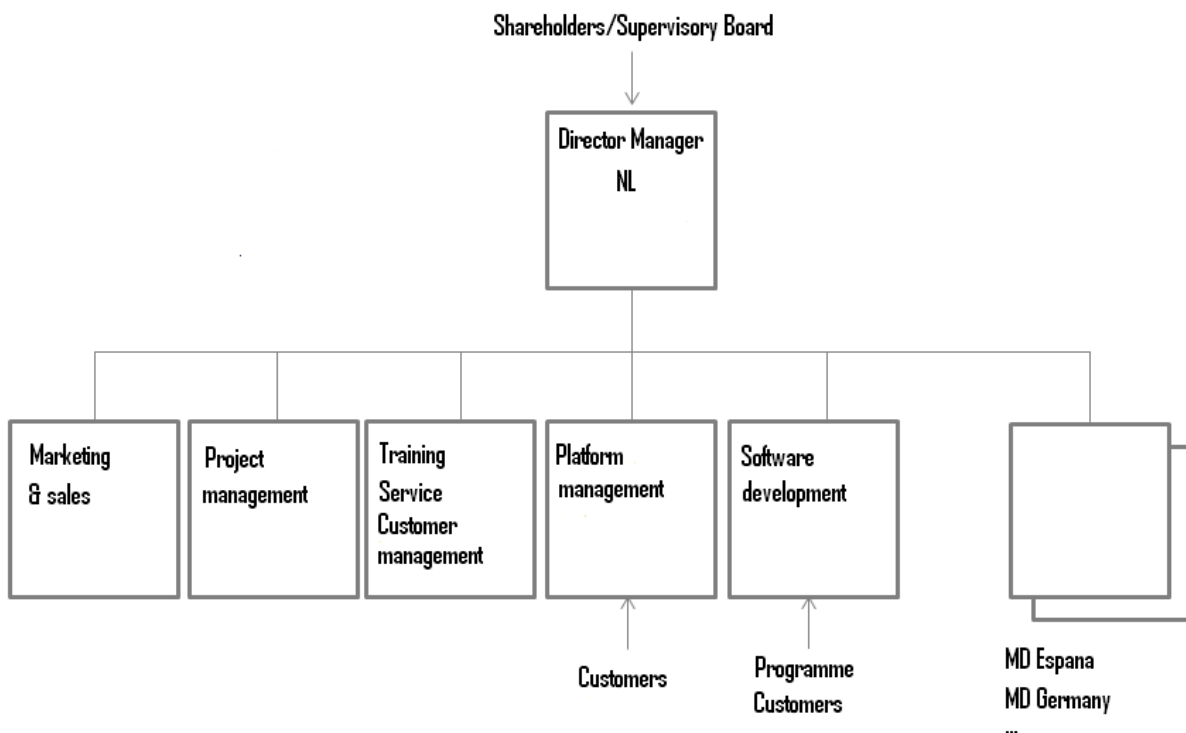


Figure 1.3: The organizational structure of Minddistrict.

1.2 Motivation of the current research

The increasing demand for mental health and addiction care will lead to a serious capacity problem within mental health and addiction care institutions (Smit et al (2007)). These

institutions have limited resources (e.g., specialists, treatment rooms, finances) and the costs for increasing the resources (e.g., hiring more specialists, overtime, building more treatment rooms) are very high. The institutions are being forced to seek for other creative solutions to use their available resources optimally to meet the ever increasing demand for their services.

E-mental health promises these institutions a cost effective solution by giving them the opportunity to do parts of the intake and mental health and addiction care process online. The institutions could handle more clients with their limited resources with the use of e-mental health. However, there is still much uncertainty about the impact of e-mental health on the efficiency and effectiveness of the services provided by the institutions, which leads to small investments in e-mental health. This thesis will attempt to give more clarity about the impact of e-mental health in terms of efficiency and effectiveness. The improvement of the mental health of a client through therapies is the effectiveness of the treatment process. Reducing costs, by reducing the amount of time and effort needed for the processes, will increase the efficiency of the treatment process.

There are many studies about online interventions and about effectiveness of several online interventions, but, as far as we know, there has been no such research about the efficiency and effectiveness of e-mental health processes performed so far. The purpose of this internship is to determine the efficiency and effectiveness of e-mental health. This will be done by analyzing data from a mental health and addiction care institution, which uses e-mental health provided by Minddistrict. The analysis will be done by comparing key performance indexes (KPI's) like treatment times, number of contacts, duration, effectiveness and productivity of the e-mental treatment process with the regular treatment process.

The effectiveness of a treatment is the change of the mental state of a client during a completed treatment program. The effectiveness will be negative if the mental state of a client is worse at the end of the treatment program compared to the beginning. Higher efficiency means getting more out of something or getting the same out of less. This can be achieved by reducing the treatment times, number of contacts, duration or by increasing the productivity. Shorter treatment times mean lower (wage) costs per treatment. Fewer number of contacts per treatment program means lower total treatment times per treatment program. Shorter duration of a treatment program means that the payment can be collected earlier, because the payment can only be collected when a treatment program is completed. Higher productivity means that a therapist can generate more income under the same circumstances.

The main research question for this internship is: what is the impact of e-mental health on the mental health and addiction care processes in term of efficiency and effectiveness? The impact will be determined by answering the following sub research questions:

1. Research of e-mental health
 1. *What is e-mental health?*
 2. *Who are the stakeholders of e-mental health?*
 3. *What potential impact could the implementation of e-mental health have on the stakeholders?*
 4. *What else is known about e-mental health from other studies?*
2. Analysis of the processes
 1. *How does the regular treatment process look like?*
 2. *How does the e-mental health treatment process work?*
 3. *What are the major differences?*

4. *What is the potential impact of those differences in terms of efficiency and effectiveness?*
5. *How can the institutions successfully implement e-mental health?*
3. Data analysis of regular and e-mental health processes
 1. *What are the KPI's for the regular and e-mental health processes?*
 2. *Is there a (significant) difference in the KPI's noticeable?*
4. Reliability of the data
 1. *How reliable is the data?*
 2. *What possible consequences does the reliability of the data have for this research?*
5. Conclusion
 1. *What conclusions can be drawn from this thesis?*
 2. *Which recommendations could be given regarding this thesis?*
 3. *What interesting future research directions would be recommendable regarding this thesis?*

1.3 Structure of the thesis

In the next chapter e-mental health will be discussed, with all its benefits and disadvantages and their stakeholders. Chapter 3 will describe the process within mental health and addiction care institutions and the effect e-mental health has on them. In Chapter 4 the KPI's from the regular mental health care and e-mental health care will be analyzed and compared. Chapter 5 will discuss the bias in the data. The thesis will end with a conclusion in Chapter 6.

2 E-mental health

This chapter will give more information about e-mental health, the stakeholders within e-mental health and past research regarding this topic.

2.1 About e-mental health

What is e-mental health? The Trimbos institute (Dutch Institute of Mental Health and Addiction) uses the following definition: e-mental health is the use of information – and communication technology (ICT) to support or improve the mental health and health care. It excludes business processes, like exchanging client information electronically, but it is about interventions that are directly aimed for clients (Smit et al (2007)).

Year	Users	Population	% Pop.	Usage Source
2000	3,900,000	16,179,500	24.10%	ITU
2003	8,500,000	16,192,572	52.50%	ITU
2006	10,806,328	16,386,216	65.90%	Nielsen//NetRatings
2007	14,544,400	16,447,682	88.40%	ITU
2010	14,872,200	16,783,092	88.60%	ITU

Table 2.1: Internet usage and population statistics of The Netherlands (source: <http://www.internetworldstats.com/eu/nl.htm> (Accessed at: 01-03-2011)).

Internet usage has exploded since it became accessible for a larger audience. Table 2.1 shows the growth of the usage of internet in The Netherlands. When it comes to using internet for information, about 89% of the Dutch population have used the internet in 2010, thus there is a great potential for e-mental health in the Netherlands. The internet provides informative and preventive information about common mental disorders and addictive substances. There is also a lot of knowledge – and self – tests available on the web and the internet provides the possibility to chat with psychologists. The internet also offers the possibility to do e-mental health anonymously, which decreases the threshold for some people to seek for mental health or addiction care. This group is expected to report their complaints and symptoms sooner.

E-mental health is said to increase the effectiveness in mental health and addiction care, reduce the costs and offer a great number of possibilities. Thus it is said that e-mental health reduces disability-adjusted life year (DALY) at relatively low costs. DALY is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability (YLD: Years Lived with Disability) or early death (YLL: Years of Life Lost), thus: $DALY = YLL + YLD$ (Havelaar (2007)). These relatively low costs could make e-mental health affordable for clients with lower incomes and for governments who fund the health care. The internet also increases the range of mental health and addiction care institutions tremendously, because anyone with a computer and access to the internet can use mental health and addiction care online. This makes these kinds of care even accessible for clients within a great distance of the institutions.

2.2 The stakeholders

This section will discuss the stakeholders of e-mental health; the potential impact e-mental health could have on them and possible barriers for a successful implementation of e-mental health. The stakeholders are the mental health and addiction care institutions, social insurers, government, clients and e-mental health providers. The goal of this section is to find out

which parties are involved with e-mental health and what their interests are regarding e-mental health.

2.2.1 Mental health and addiction care institutions

Mental health or addiction care institutions are institutions that offer mental health or addiction care to clients who suffer from depression, anxiety, schizophrenia, alcohol addiction and other mental illnesses. The ever growing demand for their services creates a capacity problem within these organizations.

E-mental health could offer a cost effective solution for the capacity problem. Doing (parts of) treatments online reduces the total time a specialist has to spent on face to face contact, which makes it possible for specialists to treat more patients in the same time. Assignments done by clients online can be checked by cheaper personnel (e.g., students) under the supervision of a qualified therapist and the more complicated cases could be forwarded to the specialists. The gap created by the no-shows can easily be filled with online treatments. It is not possible to use e-mental health in all cases, because not everyone in need of mental health and addiction care knows how to use the internet (see Table 2.1: 11 % of the Dutch inhabitants have never used the internet and it is unclear how many of the 89% are advanced enough in internet usage and are in suitable conditions to do the online therapies). Language and education can also be a barrier for clients, who are not able to read or understand the online treatments. Using a more graphical interface could help overcome this issue.

There are conflicting interests within these institutions. The directors and managers see the benefits of e-mental health and realize that e-mental health is one of the possibilities to meet the increasing demand for their services, reduce costs and increase their revenues. Because of the lower costs they would be able to offer cheaper treatments and thereby strengthen their competitive position. But most specialists prefer to keep treating their clients the way they are used to and show resistance against e-mental health. Institutions have to educate their employees to use e-mental health and emphasize the importance of e-mental health for the institution, the clients and last but not least the employees themselves. A careful change management is needed to get all the noses within the institutions in the same direction. Ensuring the employees that they will not lose their jobs could help this process.

Currently most of the therapists suffer from high caseloads: they need to do certain amount of face to face contacts within a certain time period. This contributes to a stressful working situation and could lead to a reduction of the quality given by certain therapists due to a lack of time for treating their clients.

2.2.2 Social insurers

The health insurance companies are the biggest funders of mental health and addiction care (see Table 2.2). They finance 87% of the annual expenses which are made for mental health and addiction care. The finance of the healthcare insurance had a growth of 4% from 2007 to 2008 and 12% from 2008 to 2009 for the mental health and addiction care.

	2007	2008*	2009*
Government	558	642	707
Social insurance	4,052	4,228	4,738
- ZVW (<i>Care Insurance Law</i>)	0	2,531	2,948
- AWBZ (<i>EMEA</i>)	4,052	1,698	1,790
Private health insurance	0	0	0
Private payments	0	0	0
Other funders	24	23	25
Total expenditure	4,634	4,894	5,470
% GDP	13.0%	13.3%	14.7%

Table 2.2: Sources of funding for mental health expenditures in million euro (Van Dijk et al (2010))

* Temporary data

E-mental health can reduce the costs for mental health and addiction care and thereby reduce the payments for social insurance companies on mental health and addiction care. Riper et al (2007) mentions that health insurers wonder if the offer of e-mental health will lead to a reduction or increase of the costs and in which term. Health insurers assume that both supply and demand in the mental health will grow unrestrained if there is no brake put on it. Accessible e-mental health can indeed attract additional clients in the long term. It can be also costs saving in the long term, because people can be reached before their symptoms have grown into severe psychological problems which will require intensive forms of care. This is the case if this accessible form of e-mental health does not attract groups, which could have solved their initial symptoms by themselves. Health insurers also do not know what e-mental health services they can or cannot fund.

2.2.3 Government

The Dutch ministry of Public Health, Welfare and Sports (ministerie van VWS) is responsible for the health and welfare of the Dutch inhabitants. The government seeks to improve the public health and welfare, but has announced cut backs as a result of the financial crisis. Table 2.3 shows that anxiety disorders, depression and dementia are in the top 10 of diseases in the Netherlands with the highest burdens. Psychiatric disorders often lead to absence due to illness and disability and they lead to high costs to the society. Just a disorder like depression leads to an annual societal cost of 1.3 billion euro: 15% of these costs are incurred by the use of care, the remaining 85% caused by production losses due to absenteeism (Riper et al (2007)). Table 2.2 shows the expenditure of the Dutch government on mental health and addiction care from 2007 to 2009. The expenditures in 2008 have a growth of 15% compared to the expenditures in 2007 and there was a growth of 10% from 2008 to 2009. There is an increasing trend in the expenditures of the Dutch government in mental health and addiction care. The table also shows the total expenditures on mental health and addiction care compared to the gross domestic product (GDP). There expenditures on mental health and addiction care is taking a growing proportion of the GDP. The growth of this proportion from 2007 to 2008 is equal to 0.3 %, while the growth from 2008 to 2009 is equal to 1.4% but this is also caused by a drop of the GDP from 2008 to 2009.

	Years of Life Lost (YLL)	Years Lived with Disability (YLD)	Disability-Adjusted Life Year (DALYs)
Coronary heart disease	128,400	186,700	315,100
Stroke	87,833	123,200	211,100
Anxiety Disorders	40	201,900	202,000
Depression	184	168,400	168,600
Diabetes mellitus	33,926	132,100	166,100
Lung Cancer	148,284	9,800	158,100
COPD	59,548	86,700	146,200
Osteoarthritis	719	122,800	123,500
Accident injury personal	31,051	76,300	107,300
Dementia	44,158	56,300	100,400

Table 2.3: top 10 of diseases with the highest burden in The Netherlands in 2007 (Source: RIVM, 2010)

E-mental health can help to increase the public health and wellness at a low cost. Thus, e-mental health can decrease the total costs for the use of mental health and addiction care and it can increase the productivity of the inhabitants. The productivity will increase, because of the reduction of absenteeism and improvement of the functioning of the inhabitants (at their jobs). This will not only save the government a lot of money, but will increase the GDP and thereby increase the tax income. The use of e-mental health on 25% of the clients with depression may lead to savings up to 40 million euro and 60 million euro can be added to this amount when the same percentage clients with anxiety disorders are treated with e-mental health (Medicalfacts (2010)). The government has to stimulate the implementation of e-mental health and the development in this area, because the implementation of e-mental health is going too slow. This stimulation will be hard to realize with the cut backs they have planned for the health care in the coming years. The government should think about all the benefits that e-mental health can have for them in the future (also in terms of savings. That is why they should consider investing in e-mental health.

2.2.4 Clients

A client is someone with a mental disorder or addiction. Table 2.4 shows that 44% of all Dutch inhabitants aged 18-64 years have had a mental disorder or addiction once in their lives. Every year there are 18% of men and women in this category dealing with a mental disorder or addiction. Mood disorders and anxiety disorders occur relatively more often in lives of women, while addiction, behavior or attention deficit and antisocial personality disorders occur relatively more often in lives of men.

	Ever in life			Annual		
	Men	Women	Total	Men	Women	Total
Mood Disorder	14.4	25.9	20.1	4.8	7.4	6.1
Anxiety Disorder	15.9	23.4	19.6	7.7	12.5	10.1
Addiction Disorder	27.7	10.3	19.1	7.6	3.6	5.6
Any behavior or attention deficit disorder *	11.8	6.5	9.2	2.9	1.2	2.1
Antisocial personality disorder	4.3	1.7	3.0	-	-	-
All mental disorders examined together	44.7	42.3	43.5	17.7	18.4	18.0

Table 2.4: the occurrence of mental disorders in the Dutch population aged 18-64 years in percentages ever in life and annualized (De Graaf et al (2010)).

* Attention Deficit and behavioral disorders are only measured among respondents aged 18 to 44 years. Lifetime attention deficit and behavioral disorders means in childhood or early adolescence (De Graaf et al (2010)).

Some clients live at far distances from mental health and addiction care institutions. These clients can save themselves a lot of effort, time and money by using e-mental health. In Riper et al (2007) it is mentioned that the RVZ report of 2006 show that three quarters of the internet users in 2005 (9 million people) also used the internet to search for information about health or care. 15% of this group was looking for information about depression. Half of the internet users indicate that searching information about health problems on the internet improves the communication with the specialist, because these internet users know more about their health issues. Information found on the internet also supports clients in following the instructions of the specialist. The treatments are online, thus accessible and available 24/7. Clients can work on their therapy in their own time and pace. This makes it possible for clients to spend time on their therapy after their job or before going to bed (lower threshold). Clients can read back information about previous treatments, which can help to keep the information fresh into their minds. This can prevent setbacks and clients will not need that much face to face therapies regarding already handled issues, due to forgetfulness. Writing has a therapeutic effect ((Van Emmerik et al (2008) and Van der Oord et al (2008)). Writing about issues can be very effective and can create a better awareness for clients than just talking about those issues. Writing also calls upon both feelings and intellect, which helps to distinguish the main and secondary issues.

Although e-mental health and addiction care can have many benefits for clients, not all clients are familiar with the internet and therefore it is not possible to completely replace face to face contacts with online contacts. There are clients who prefer to speak to a specialist instead of following online therapy. The needs of these clients will have to be taken into consideration.

2.2.5 E-mental health providers

E-mental health providers are companies which provide mental health and addiction care institutions with tools to do (parts of) treatments online. These companies develop online interventions and other services to make the treatment of clients more convenient for the clients and the specialists. Minddistrict is an e-mental health provider.

There are many uncertainties about the funding of the services offered by the providers. Riper et al (2007) mentions that two thirds of the services offered by the providers are unpaid, although these services do bring along costs with them for the providers. This is particularly the case for preventive e-mental health. These services are funded by different sources and often for internal project basis (AWBZ (EMEA funds), investment funds, donations, grants or third parties such as employers or clients themselves). This uncertain financial situation is a

threat for the continuity of these services. They also need to know which services will be part of the insured care now and in the future. There is also uncertainty about the financing of the anonymous services. These are free services which clients can use anonymously, which decreases the threshold for some people to seek for help for their complaints and symptoms. Stakeholders, including insurers acknowledge the importance of anonymous services and are positive towards it.

2.3 Previous studies about e-mental health

In this section previous studies about e-mental health will be discussed. These studies are about the recent developments and future of e-mental health and the strengths and weaknesses of e-mental health. To get an idea of the revenues and costs of e-mental health institutions some experts at Minddistrict were interviewed during the internship.

2.3.1 Recent developments and future

E-therapy has risen due to the rapid developments of the technical possibilities and the high demand of consumers for these services (Turkensteen (2008)). It all started in 1900 with the instructions of doctors through the radio to crewmembers of ships. Physicians began to use the phone to consult each other from the twenties and in 1959 the first telemedicine project was launched in the US. The University of Nebraska maintained the first interactive video contact in 1964 with a psychiatric hospital 200 km away. The rapid developments of the computer from the early eighties and the use of the World Wide Web (WWW) led to an explosive growth in the use of these technologies.

Currently there are many existing internet therapies for anxiety and mood disorders such as: panic disorders, social phobia, depression, post-traumatic stress disorder, etc. There are also internet therapies in the area of health psychology such as: headache, sleeping disorders, chronic pain, smoking, breast cancer, etc. Many other symptoms can be treated via the internet such as: stage fright, losing weight, obesity, stress, etc.

Turkensteen (2008) also mentions that there are five internet therapies, which have been proven to be effective using Randomized Clinical Trial (RCT). These are the therapies for panic disorder, posttraumatic stress disorder, depression, burnout and mild depression for people over the fifty.

Atos Consulting (2011) discusses different possible future scenarios for e-mental health by interviewing 30 experts, recognizing 21 trends and using the 2 highest scoring trends for the different scenarios. These trends are the growing influence of the health insurers and the increasing privatization of care. Here are some of the other trends:

- Client related trends:
 - people are living longer
 - people know more about their diseases because of all the information available on the internet
 - shift in the attitude of the clients from disease management to health management (prevention of diseases)
- Organization related trends:
 - the increasing availability and use of technology
 - merges between mental health and addiction care institutions
 - further specialization of care

- better insight in the quality and quantity of the care (KPI's for clients, health insurers, health inspection, ministry of VWS and the institutions themselves)
- Sector related trends:
 - the increasing costs
 - shortage of qualified personnel
 - growing attention for quality and client safety
 - growing financial risks for mental health institutions
 - the focus of mental health institutions to increase their market positions and to create new market opportunities

E-mental health becomes more important in all the scenarios discussed by Atos Consulting (2011), but the way e-mental health is implemented (in particular the growth rate) is different in the different possible scenarios. There is still much experimentation with e-mental health: what is the best approach, the technology to be deployed, what is the optimal balance between face-to-face and internet, how can the business case be made positive and which processes create a maximum support and maximum results? However, no groundbreaking results have been achieved so far that take away all doubts.

Unanswered questions are: how much should be invested, what are the risks, which returns can be expected and when? Mental health institutions and health insurers are willing to invest in e-mental health, because they expect a positive effect (in long term). An important step is that the health care insurance board has classified some applications of e-mental health as insured care. The government has not given any indication that the positive attitude towards e-mental health will result in making funds available for it. Reduction of costs regarding the decrease of absence should be taken into consideration for addiction care to make their business cases positive (Kok et al (2010)). Thus this is a good investment on a national level (macro economical), but it has negative business cases for the mental health care institutions and the health insurers.

Atos Consulting (2011) mentions the following barriers for e-mental health: the financing, laws and regulations, unawareness of the possibilities/availability of e-health for the clients, lack of or insufficient medical evidence, standardization of e-health services, specialists lack experience in working with ICT and care is regulated from the demand side (e-health services are developed from the current supply of services) .

2.3.2 Revenues and costs for the institutions

Experts in the field of mental health, such as colleagues at Minddistrict, were interviewed for this subsection. These interviews were done to find out more about the revenue and costs structure of the mental health and addiction care institutions.

Revenues

A therapist opens a DBC (in English: Diagnosis Treatment Combination (DTC)), whenever a client visits him with a new complaint, which the client is not being treated for yet. A DTC labels the care process that results from the care needs of the client. The cost per DTC is calculated based on the care process related activities and operations within an institution (DBC GGZ (2003)). A specific DTC is only valid for one year. When a client needs more time than 365 days a new DTC will be opened.

A DTC gives an indication of what time interval will be needed to treat a client with a certain complaint (there are different DTC's for different treatment programs). The mental health and addiction care institution will receive funds, when the whole treatment program of a client is completed (when the DTC is closed). The institutions will receive payments from the social insurers depending on the time indicated by the DTC. The mental health care or addiction care institutions do not get paid for the extra time needed for a complete treatment program. Thus, if the institution needs more time to treat a patient than indicated by the DTC, then the extra time will be at the expense of the institution. It is possible to open multiple DTC's for clients which are diagnosed with multiple/complex mental issues.

Thus e-mental health could help the therapist in handling their clients within the time indicated by the DTC. If this is the case, then a therapist could be able to handle more DTC's per year, which will lead to more income for the mental health and addiction care institutions. This is also a reason why many institutions are interested in e-mental health. It does not only reduce unpaid treatments from their therapists, but could also generate more income.

The DTC also contains all kinds of useful information such as:

- Directly treatment times: the time needed for all individual treatments.
- Indirect treatment times: the time needed to document/prepare for all the individual treatments.
- The Global Assessment of Functioning score (in short: GAF-score) is a measurement, which indicates the psychological, social and professional functioning of a person designated in the form of a score between 0 and 100. The GAF-score is part of the DSM-IV system (Diagnostic and Statistical Manual of Mental Disorders), which is used to diagnose psychiatric disorders. "Normal" people, with regular 'daily' problems, score around 100. People with mental and/or social problems score lower (MacKenzie (1997)). A DTC contains the highest GAF-score during the length of the DTC and the GAF-score at the beginning and the end of the DTC.

Costs

About 20% of the costs of a mental health institution are related to the IT-staff, secretaries, etc. The costs related to therapists cover the other 80% of the total costs of the institution. About 30% of the costs are non-client related costs such as training, development of expertise, meetings, etc. The other 70% of the costs for therapist are client related costs of which about 75% are for the costs for the directly treatment times and about 25% the costs for the indirect treatment times.

Other costs for the institutions are the costs for the buildings and rooms in which the contacts between the therapists and clients take place and the declaration of the traveling costs the therapists make to go to the institution.

The use of e-mental health will increase the costs for IT-staff. The institutions will need more IT-personnel to keep the site running and help the therapists with IT related problems. But the use of e-mental health will reduce the costs needed for traveling and it will reduce the costs regarding the reservation of a room for a therapy session.

2.3.3 Strengths and weaknesses of e-mental health

Table 2.5 gives an overall view of the relative strengths and weaknesses of e-mental health. The weaknesses are divided in weaknesses that can be solved and weaknesses that will be difficult to solve.

Strengths	Soluble weaknesses	Difficult to solve weaknesses
Large range	Little insight into quality	Exclusion criteria
Accessibility	Privacy risks	Accessibility in crisis
Cost effective	Not focused legislation	Risk of social isolation
Proven effective	Not focused professional codes of conduct	Absence of non-verbal communication
Won healthy life	(Individual) security risks	Reduced sense of presence
Evidence based	Uncertain fees	Increased therapists efforts
More efficient working time	Uncertain grants	Dependency on computer and internet
Short-term	Ethical issues	
Structured and logged	Informed consent is not required	
More efficient screening	Lacking warranty professionalism	
Stepped care procedure	Uncertain responsibility	
Efficient care	Lack of overall view	
Own time, place and pace		
Evading stigma therapy		
Anonymity		
More experienced control		
Time for reflection / evaluation		
Remember by possibility to read / see / hear (back) info		
Writing is healing		
Contact-peer support		
Client empowerment		
Therapeutic working relationship		
Higher frequency of treatment contacts		

Table 2.5: the strengths and weaknesses of e-mental health (source: Turkensteen (2008)).

There are many benefits when using e-mental health as it can be seen in Table 2.5. Most of the weaknesses of e-mental health can be solved and most of the difficult to solve weaknesses can be avoided by offering a blended form of therapy. The f2f contacts will not be completely replaced by online contacts. For example the therapist could switch to f2f contacts in crisis situations. The dependency on a computer and internet can be reduced by offering blended therapies. Therapists can be trained in how to compensate for the absence of non-verbal communications and how to perform online therapies efficiently (with less effort). Institutions that are considering the implementation of e-mental health should ask themselves what the benefits and disadvantages e-mental health would have for them and always consider the costs versus the benefits.

The strength and weakness analysis shows that internet therapies can be a great addition to the existing mental healthcare and that most problems are caused by the relative novelty of e-

therapy. It is important to devote the needed attention to these problems to resolve them at an early stage (Turkensteen (2008)).

3 Process analysis

In this chapter the entire treatment process within mental health and addiction care institutions will be described, from the moment a client applies for a treatment program until the client has been released from that treatment program. The acceptable waiting times for each process step will also be discussed. The impact of e-mental health on the process will be analyzed and the main differences will be discussed.

Lean management will be discussed in section 3.3, because e-mental health can help eliminate certain types of waste. Change management will be discussed in 3.4, because e-mental health changes the way people work within the institutions. It is crucial to use the right type of change management to successfully implement e-mental health within the institutions.

3.1 Regular mental health care process

Clients are in most cases forwarded to mental healthcare institutions by their general practitioner. The client has to apply for treatment at the mental health or addiction care institution with the reference form given by the general practitioner. The client will be registered by the institution into their system and will make an appointment for the first meeting. Table 3.1 contains treek standards, which indicate the acceptable waiting times for clients of mental health or addiction care institutions. The table shows that the acceptable waiting time between the application (Application & Registration) and the first meeting (Screening & Intake) is equal to 4 weeks.

Mental Health	Treek standards (in weeks)
<i>Application</i>	4
<i>Assessment</i>	4
<i>Extramural treatment</i>	6
<i>Intramural treatment</i>	7
<i>Protected living</i>	13

Table 3.1: Treek standards for the mental health and addiction care (Source: Nederlandse Autoriteit (2011)).

During this first meeting the client will have an interview with a psychologist, who will diagnose the client during the interview and indicate the GAF-score of the client. The psychologist will set up a treatment plan after the first meeting based on the diagnosis and the severity of the symptoms. The acceptable waiting time between the first meeting (Screening & Intake) and the set up for the treatment plan (Treatment Plan & Treatment) is equal to 4 weeks (see Table 3.1).

A new DTC will be opened after the Screening & Intake phase. The DTC contains information about all contacts between clients and therapists. It can be seen as a time registration for the treatment of a client for one specific diagnosis. Multiple DTC's might be activated, for clients who are treated for more than one disorder. There are different DTC's for each type of diagnosis. Each type of DTC gives an indication of the total treatment time needed for the given diagnosis.

After the set up of the treatment plan there will be numerous contacts between the client and therapists (therapy). These contacts can be face to face or through the phone. Face to face contacts take place at the institutions. The client has to visit the institution for these types of

sessions. Each of these sessions contains about 45 minutes of directly treatment time. This is the time the therapist spends talking to the client about his or her issues and the progress of the client. The indirect treatment time is the time the therapist needs to prepare for a therapy session (before the therapy session) or document about the therapy session (after the therapy session). Thus the indirect treatment time can be seen as the time needed to do the administrative work for the treatments.

After the treatments there will be an evaluation of the whole treatment program and the progress made by the client. The therapist can decide to end the treatment completely or refer the client to a new treatment program regarding a different complaint or the same complaint which could be less severe now, but still needs to be given the right amount of care. The therapist also will indicate a GAF-score at the end of the treatment program. Figure 3.2 gives a description of the regular mental health and addiction care process as described in this section.

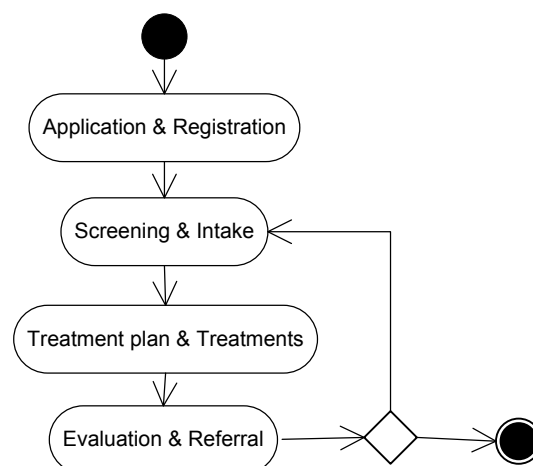


Figure 3.2: Description of the phases of the regular mental health care process.

3.2 E-mental health care process

A client can apply directly for treatment online. There are 5 categories a client can choose from in the Minddistrict online treatment center:

1. Online treatment: this is a normal registration for a client for the online treatment center.
2. Anonymous online treatment: this registration form allows the client to stay anonymous during the treatments.
3. Loved ones: this registration form is for the partner, family or friends of the client who have been suggested to register by the therapist of the client.
4. Online treatment from your own therapist: this offers the possibility for clients to register for online treatments by their current therapist (who also performs online therapies).
5. Coaching: this registration form is for an online coaching program.

For each form of registration a client has to fill in the information below. Table 3.3 shows the information that is needed for the different types of registrations online.

Type of registration Information needed	Online treatment	Anonymous online treatment	Loved ones	Online treatment from your own therapist	Coaching
Personal information	X	Limited	X	X	X
Address information	X		X		X
Contact information	X	Limited	X	X	X
Education and employment status	X		X		X
Cultural origin	X		X		X
Description of the complaint	X	X	X		X
Selection of a program the person wishes to follow	X	X	X		X
General practitioners information	X		X		
Health insurance information	X		X		
Information about how they found Minddistrict	X		X		
Payment information					X

Table 3.3: Needed information for the different registration categories.

An application of a client can be approved by a planner. The planner checks all the information given by the client first and then he can accept or decline an application. A therapist will be appointed for a client after the application has been accepted by the planner and an intake will be selected for the client by the planner. A notification for the new client will be automatically sent to the therapist through an e-mail.

Meanwhile the client will receive an e-mail with his username and password. The client can start with his intake when he logs on to the online treatment center. The intake will start with some information about the intake and after that the screening will start. The client can choose to send the screening results to the therapist when all the questions are answered.

The therapist will receive a notification per e-mail that the screening has been done by the client. The therapist can check the results of the screening and sent feedback to the client with questionnaires for other interventions (these questionnaires are optional). The therapist can create a specific treatment program for the client and the treatments can start when the client agrees with the treatment program proposal of the therapist.

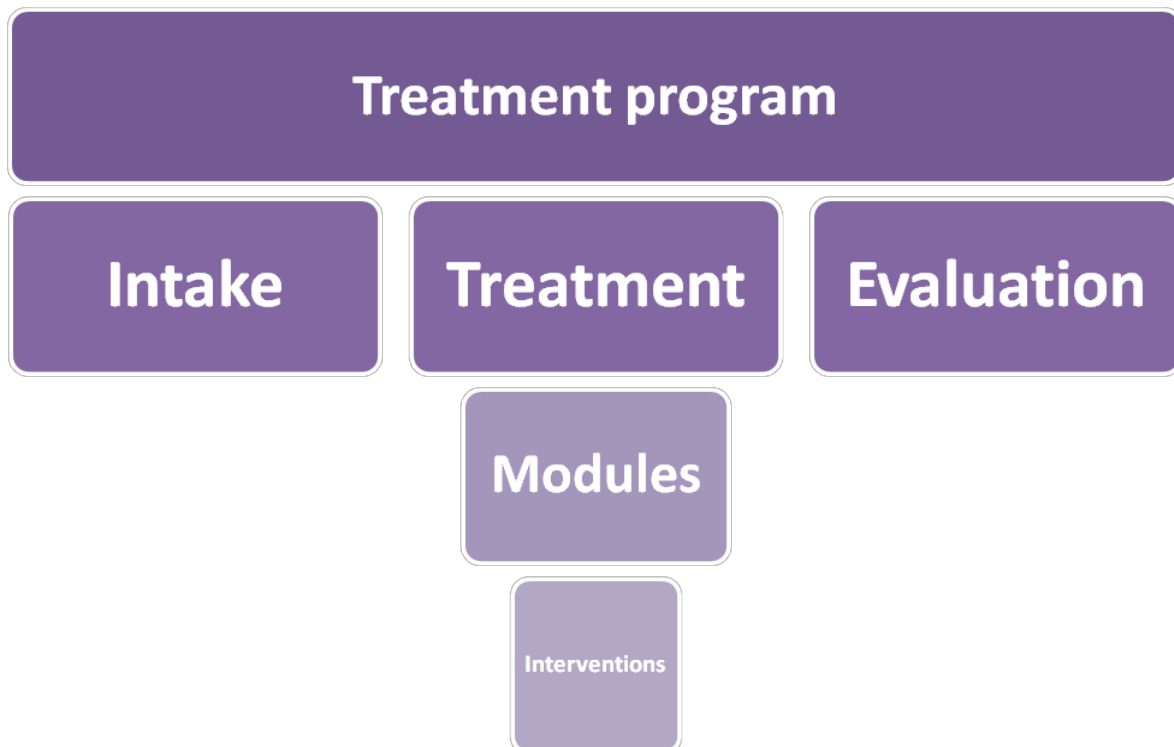


Figure 3.4: The structure of the e-mental healthcare process.

Figure 3.4 shows the structure of the treatment program. A treatment program contains an intake, treatment and evaluation phase. The treatment consists of at least one module. A module consists of at least one intervention. Each Intervention consists of information, exercise and feedback. The client has to read the information first before doing the exercise. When the client is done with the exercise he can choose to send this to his therapist. The therapist will receive the results of the exercise and can give feedback and assignments to the client. Figure 3.5 shows the structure of an intervention and actually the interaction between the client and the therapist.



Figure 3.5: Online interaction between client and therapist.

Therapists can also contact each other regarding issues of a client they both treat or discuss certain client related matters. There is even the possibility to do crisis interventions online.

3.3 Lean vs. e-mental health

Lean is a management philosophy which aims to eliminate waste (Muda). Waste is everything that does not add value for the customer. Value is defined as any action or process that a customer would be willing to pay for. There are 7 types of waste: transportation, inventory, motion, waiting, over-processing, over-production and defects. This method was developed by the Toyota executive Taiichi Ohno. This new method was labeled as lean production by Womack et al (1996) because it does more and more with less and less. The advantage of this method is that all the energy and creativity of the company will be focused in optimizing all aspects that are perceived as valuable for the customers (e.g., price, quality, delivery, maintenance, and environment) at low internal costs. Safety, working hygiene and ergonomics also improve when setting up and optimizing business processes. The disadvantage is that since all energy and focus of the company is aimed at improving the existing products, the chances of discovering new innovative technologies will be less. The implementation of successful systems requires extensive preparation, while the results will not be noticeable in the short-term. Besides this the participants will have to switch from short-term thinking to long-term thinking. It is often underestimated how much effort and time it takes to switch the attitude towards work and business of an entire organization.

According to Womack et al (1991) the Japanese car manufacturers built their cars in the eighties in half the time, with half the people, half the stock, half the space and half less errors than their Western competitors. They also seemed to be twice as flexible. They produced various models of cars together depending on the needs of their customers. They managed to produce products of a higher quality with lower costs. Womack et al (1996) formulated some basic principles of Toyota, so other organizations could also apply this method.

Lean thinking and doing has become a hot topic in health care. Theadacare Center for Healthcare Value and Virginia Mason Medical Center are the most mentioned hospitals for the application of lean thinking. Both American hospitals started with the implementation of lean thinking about 10 years ago. Benders et al (2010) contains 8 stories about the practice of lean thinking in the health care in The Netherlands.

There are currently some mental health and addiction care institutions implementing lean thinking within their organization. Lean thinking is not just a way of working, but a way of living. E-mental health could help make the processes within mental health and addiction care leaner, by eliminating the following types of waste:

- **Transportation:** The clients and therapist have to move to a specific place (buildings of the institutions) for the treatments. By doing treatments online, this type of waste can be eliminated, because the therapists and clients can perform these types of treatments anywhere as long there is a computer with internet available.
- **Motion:** The therapists do not have to guide the clients from the waiting room to the therapy room when the treatment is done online.
- **Waiting:** Because of the limited resources (therapists and space) the institutions have for treatments, many clients end up in waiting lists. By offering clients in waiting lists the possibility to do (only) online treatments until there are enough resources available

for f2f treatments, will reduce the waiting times and make the needed care for clients available sooner.

- **Over-processing:** There are many highly qualified personnel needed for treating all the clients according to the regular treatment process. These types of personnel are expensive. Most feedback for online treatments can be done by less qualified (cheaper) personnel. This gives the highly qualified personnel the opportunity to focus (only) on the more complicated cases and supervise the less qualified personnel.
- **Over-production:** There are many f2f contacts needed in the regular treatment process. These types of contacts are very costly. By doing certain treatments online the number of f2f contacts per treatment program can be reduced.
- **Defects:** The therapies could be lead by different therapist in many different ways and not all of these ways might be effective. By using standardized protocols for online treatments the treatments will become more similar and create the same effectiveness. The online treatment program will guide the therapist through the treatment of the client, which will reduce the variance. By improving these standards all the therapies will be improved.
- **Inventory:** Treatment programs in progress (work in progress), medicines and other raw materials can be seen as inventories. These inventories can be managed better, because all the medical records are also saved in a database. Mathematical models can help optimally manage these inventories.

The implementation of lean within the institutions requires a change in their way of working and doing business. The next chapter will discuss change management.

3.4 Change management for e-mental health

Changing the treatment process for mental health and addiction care brings a lot of resistance with it. Therapists are used to treat clients in certain ways. They have been treating clients according to the regular treatment process for years. Changing the way therapists work for years will not be easy. Most of these therapists did not learn about e-mental health and how to treat clients online during their education. Educating therapists in how to treat online and the benefits it can have for them and for the clients can help the therapists in changing the way look upon online treatments.

For successful change management it is crucial to define measurable aims for the stakeholders. Business cases should be created to achieve these goals and it should be continuously updated. The assumptions, risks, dependencies, costs, return on investment, disadvantages and the cultural issues that affect the progress of the associated work should be monitored. The various stakeholders should be kept informed about the reasons for the change, what benefits a successful implementation will have for them. They should also be informed about the details of the change: they should know when, where, who is involved, how much it will cost, etc. for the changes. The institutions should think of an effective way to educate, train or upgrade the skills of the organization. Resistance of the employees should be countered and they should be aligned to the overall strategic direction of the institution. Employees with change related fears should be offered personal guidance if needed. The implementation should be monitored and fine-tuned if required (Hiat et al (2003)).

Minddistrict gives trainings to therapists of institutions to treat online and about all the benefits. Most of these therapists are very skeptical at the beginning, but they become more optimistic at the end of the training. Still not all of these therapists are performing many

online treatments after these trainings. They all have busy treatment schedules and do not have the time to investigate the possibilities online treatments can have for them. Getting the therapists more involved should be the main concern of the institutions. Offering e-mental health as a tool for the therapists and having them decide how it could contribute to the wellbeing of the clients should be the central question. The therapists should be given time to explore the possibilities of online treatments.

Perhaps it would help to monitor certain online treatments and compare these with the f2f treatments of the same kind during a period. The results of these experiments should be presented to the therapists, so they will know the benefits for themselves and the institution. Therapists should also share their experiences in how to treat online, so they can learn from each other and improve the quality of the online treatments for the benefit of the clients.

4 Data analysis

In this chapter the data of one mental healthcare institution will be analyzed. The dataset contains 113,482 records of contact information (e.g., date, directly treatment time, indirect treatment time, client, therapist etc.), 7,472 records of Diagnosis Treatment Combination information (e.g., income, GAF-scores, primary diagnosis, etc), 4,712 records of client information (e.g., age, gender, location, etc.) and 1,018 records of therapist information (e.g., age, gender, hourly costs etc.). The data only contains contact information from all the DTC's that were opened from 01-01-2008 until 10-06-2011 for anxiety disorders and addiction disorders. Unfortunately there was no data available for this research regarding the waiting times, no-shows and only the hourly costs were available of some therapists. The name of the institution will not be mentioned due to the protection of their privacy.

In the coming sections the data will be analyzed at different levels. Analyzing the data in such a way will give more insight in the entire treatment process and the impact that e-mental health has on the mental health and addiction care processes in terms of efficiency and effectiveness. The overview below shows which KPI is discussed at which level:

1. Contact level:
 - Average treatment time per contact
 - Number of contacts
2. Contact type level:
 - Average treatment time per contact type
 - Number of contacts per contact type
3. Client level:
 - Average total treatment time per client
 - Average number of contacts per client
4. Therapist level:
 - Average total treatment time per therapist
 - Average number of contacts per therapist
 - Average productivity of the therapists
5. DTC level:
 - Average total treatment time per DTC
 - Average duration per DTC
 - Average effectiveness per DTC
 - Average number of contacts per DTC

The KPI's which tell the most about the impact of e-mental health on the mental health and addiction care processes in terms of efficiency and effectiveness are underlined in the overview above. The KPI's of the regular treatment process (f2f) and the e-mental treatment process (online) will be distinguished, so they can be analyzed and compared with each other. The KPI's at client, therapist and DTC level will be shown on a yearly basis. E-mental health was implemented in 2010, therefore the KPI's from 2010 and 2011 will be split to f2f KPI's and blended KPI's. Blended are those clients, therapists and DTC's that have both f2f and online contacts. This will make it possible to analyze and compare the f2f KPI's with the blended KPI's.

The discussion about the data will be in Chapter 5. There is a bias in the data, because the clients and the therapists that perform online treatments are not chosen randomly. The discussion about the bias and the results found in this chapter will also be in Chapter 5.

4.1 Data analysis at contact level

For the analysis at contact level all the face to face and online contacts will be analyzed separately. Table 4.1 shows the number of contacts that took place in the years 2008 until 2011. The table shows that the number of contacts is increasing every year. The values for 2008 and 2011 are incomplete. The dataset only contains data of DTC's which were opened in 2008, thus the dataset does not contain the information of contacts in 2008 of DTC's which were opened earlier than 2008. The information about 2011 is incomplete, because the dataset only contains data until 10-06-2011. Thus only the contacts information of 2009 and 2010 are complete. The growth rate of the number of contacts between 2009 and 2010 was equal to 6.6%. The first online contact for the institution took place on the 8th of January 2010. Only 1.70% of the contacts in 2010 were online, while in 2011 only 2.18% of the contacts took place online. The proportion of the online treatments is very small. Thus, the influence of these online treatments will be very small on the annual KPI's.

Period	Nr of contacts		
	Online	F2F	All
2008	0	27,885	27,885
2009	0	33,574	33,574
2010	607	35,170	35,777
2011	354	15,892	16,246
All	961	112,521	113,482

Table 4.1: Number of contacts.

Table 4.2 shows the average directly and indirect treatment times of the therapists. There is a descending trend in the variance of the directly treatment times and indirect treatment times. There is also a descending trend in the average directly f2f treatment times. The fact that therapist get more routine in their work could be the reason for this phenomena. This causes less variation between the treatment times and also reduces the average treatment time. The average indirect treatment times show a growing trend. The reason for this could be the fact that therapists are required to document more and more about the treatments and enter more data in the DTC's. The indirect time takes about 25% of the total treatment time in the case of the f2f treatments, while it takes 23% for the online treatments.

Period	Average treatment time (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2008	0	32.64	32.64	0	10.39	10.39
2009	0	31.97	31.97	0	10.55	10.55
2010	28.83	31.81	31.76	8.14	10.86	10.81
2011	30.49	30.46	30.46	9.82	10.97	10.95
All	29.44	31.87	31.85	8.76	10.67	10.65

Table 4.2: Average directly and indirect treatment times.

The growth of the average directly online treatment times is remarkable. One would expect a decrease in the average treatment time here, because therapists would have more routine in treating online in the second year, but there is a significant growth (p-value of 0.025, Mann-Whitney test) instead. The Mann-Whitney test was used here because the treatment times are not normally distributed (see Appendix A for the histograms and QQ-plots of the treatment times). The reason for this growth could be the fact that new therapists were trained for online treatments in 2011, which means that these new online therapists might have needed more time to treat their clients online. This was confirmed by the e-mental health manager of the institution.

The table also shows that the online treatment times (directly and indirect) are significantly shorter than the f2f treatment times every year, except for the directly treatment times in 2011. The directly f2f treatment times in 2011 were significantly shorter than the online treatment times in the same year, although the averages of the treatment times f2f and online just differ 0.03 minutes (equal to 1.8 seconds). It will take time for therapists to get routine in online treatments. Newly trained therapists start with an experience of zero and could cause a growth in the online treatment times. Appendix B discusses the significance of the differences between the online and f2f treatment times.

4.2 Data analysis at contact type level

There are 41 different types of contacts retrieved from the data. Only 9 of these types were also performed online. This subsection will deal with the contact types that are also performed online. Appendix C gives an overview of the 32 contact types that were only performed f2f in the period of the dataset.

Program type	Nr of contacts		Average treatment times per program type (in minutes)			
	Online	F2F	Directly online	Directly F2F	Indirect online	Indirect F2F
Additional diagnostics	1	1,392	15.00	52.24	5.00	19.57
Cognitive (behavioral) therapy	700	5,467	30.23	41.68	8.58	12.64
Communicative therapy	1	24,068	30.00	30.34	15.00	11.01
Group therapy	1	3,551	30.00	13.68	15.00	3.88
Individual psychotherapy. (Other)	21	4,024	41.43	47.13	15.48	11.49
Intake	5	8,163	24.00	49.30	12.00	24.74
Internet treatment	10	11	26.40	17.73	10.50	14.55
Psycho education	55	66	24.04	32.36	9.11	10.97
Supportive and struct. Therapy	167	18,389	26.85	40.53	8.29	11.48

Table 4.3: Number of contacts of each type and the average treatment time per contact type online and f2f separately.

Table 4.3 shows how many of a certain type of contact took place. Additional diagnostics, communicative therapy, group therapy took only place once. This could point out that the institution is experimenting with doing more types of contacts online. Most of the online contacts are of the type cognitive behavioral therapies, while most of the f2f contacts are of the type communicative therapy.

The average online treatment times are lower in almost all the cases. The average treatment times for f2f is lower than the averages for online only for the group therapies and internet treatment. Only 1 contact of the type group therapy took place online, so that does not say much. Furthermore, it does not make any sense to have internet therapies online and f2f. Internet therapies are always performed online by definition. This could mean that the data was incorrectly entered in the database of the institution. The average indirect f2f treatment times are lower than the averages of online for communicative therapies, group therapy and (other) individual psychotherapies. There was only 1 online contact of the types communicative and group therapy thus that does not say much. The number of (other) individual psychotherapy that took place online is very small compared to the ones that took place f2f.

There is a bias in the data and that is why the *ceteris paribus* principle will be used. *Ceteris paribus* is a Latin phrase which literally means “with other things the same” (Miller et al (2010)). The impact of e-mental health on the treatment times per contact type can be predicted, by assuming that all other things are equal or held constant from 2008 to 2011. This

principle will only be used for those types of contacts, where the number of online contacts is relatively high compared to the total number of contacts. Psycho education (45% contacts online) and cognitive (behavioral) therapy (11% contacts online) have the highest percentage of online contacts. Appendix D has histograms of the average annual treatment times (directly and indirect) and a table with the annual number of contacts of that type that took place and the average annual treatment times online and f2f.

Table D.3 clearly shows that the average treatment times for online contacts of type cognitive (behavioral) therapy are lower than f2f. But the total annual average treatment times (directly as well as indirect) show an increasing trend. This means that the average treatment times of the f2f contacts in 2010 and 2011 have increased tremendously, which cancels out the possible positive effect the online contacts have. Thus e-mental health has no positive (total) impact in this case (by not reducing the average annual treatment time of all the contacts). Table D.6 also shows that the average treatment times for the online contacts of type psycho education are lower than f2f. In 2010 and 2011 the annual average treatment times (directly as well as indirect) are lower than in 2009 (when only f2f contacts took place). The positive impact of the online contacts is greater here; since the percentage of the contacts that took place online is also high (26% in 2010 and 63% in 2011 of the contacts were online). But it is remarkable that the average annual treatment times in 2011 are higher than in 2010, while percentage that took place online in 2011 is much higher. Table D.6 also shows a growth in the number of contacts of the type psycho education. From 2010 to 2011 there was a growth of 316% (note that 2011 contains data from only a half year). The increasing number of these kinds of contacts might be the reason why there also is a growth in the annual average treatment times.

Thus the e-mental health has a positive impact on the reduction of the treatment times, but because the number of contacts that take place online is still a too small part of the whole, the impact is being cancelled out. In future research when the number of contacts is much higher, more valuable conclusions can be made regarding this.

4.3 Data analysis at client level

This section will analyze the data of the institution at the client level. Table 4.4a gives an overview of the average annual total treatment times per client. There is an increasing trend in the average total treatment time per client.

Period	Average total treatment time per client (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2008	0	442.87	442.87	0	141.05	141.05
2009	0	471.04	471.04	0	155.37	155.37
2010	8.07	515.85	523.92	2.28	176.03	178.31
2011	7.17	321.39	328.56	2.31	115.78	118.09
All	<u>6.42</u>	<u>813.82</u>	<u>820.24</u>	<u>1.91</u>	<u>272.32</u>	<u>274.23</u>

Table 4.4a: Average annual treatment times per client.

Table 4.4b gives an overview of all the clients that were treated only f2f in the period that online treatments were available (from 2010). The minimum total treatment time (directly + indirect) for the f2f clients was 10 minutes and the maximum was equal to 31,343 minutes in 2010.

Period	Average total treatment time per client (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2010	0	520.58	520.58	0	177.9	177.9
2011	0	324.66	324.66	0	116.55	116.55
All	0	818.16	818.16	0	273.68	273.68

Table 4.4b: Average annual treatment times for the f2f clients.

Table 4.4c gives an overview of all the clients that were treated blended (online and f2f). The total online treatment time per client was 43% in 2010 and 38% in 2011. The minimum total treatment time for the blended clients was 207 minutes and the maximum was equal to 2,375 minutes in 2010. The average total treatment times (directly + indirect) for the blended clients are higher than the ones for the f2f clients.

Period	Average total treatment time per client (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2010	277.79	358.03	635.82	78.4	113.24	191.64
2011	161.1	251.12	412.22	51.91	99.19	151.1
All	285.81	625.13	910.94	85.02	212.94	297.96

Table 4.4c: Average annual treatment times for the blended clients.

Table 4.5a gives an overview of all other results of the analysis at client level. There are around 2,200 clients being treated at the institution annually for anxiety disorders and addiction. The number of DTC's per client varies from 1 to 6 during the whole period. The number of therapists a client is treated by during the data period varies from 1 to 37. In average a client needs about 15 contacts per year.

Period	Nr of clients	Averages per client		Average nr of contacts per client		
		Nr of DTC's	Nr of therapists	Online	F2F	All
2008	2,055	1.11	2.25	0	13.57	13.57
2009	2,279	1.28	2.28	0	14.73	14.73
2010	2,169	1.31	2.35	0.28	16.21	16.49
2011	1,506	1.14	2.02	0.24	10.55	10.79
All	4,407	1.57	3	0.22	25.53	25.75

Table 4.5a: Other results from the analysis at client level.

The tables 4.5b and 4.5c divides the information from table 4.5a in 2 groups: f2f clients and blended clients.

Period	Nr of clients	Averages per client		Average nr of contacts per client		
		Nr of DTC's	Nr of therapists	Online	F2F	All
2010	2,106	1.32	2.35	0	16.42	16.42
2011	1,439	1.14	2.03	0	10.72	10.72
All	4,308	1.57	3	0	25.75	25.75

Table 4.5b: Other results from the analysis at client level for the f2f clients.

Only 3.0% of all the clients in 2010 were treated blended, but in 2011 there were 4.7% clients treated blended. Blended clients needed 43.1% less f2f contacts than the f2f clients in 2010, but needed 15.6% more contacts in total in the same year. Thus there is a reduction in the number of f2f contacts, but this gap is filled by more online contacts. It can be concluded that one replaced f2f contact is equal to 1.36 online contacts (averagely), when analyzing the reduction of f2f contacts by treating clients blended and comparing this with the number of online contacts that replace them.

Period	Nr of clients	Averages per client		Average nr of contacts per client		
		Nr of DTC's	Nr of therapists	Online	F2F	All
2010	63	1.14	2.11	9.63	9.35	18.98
2011	67	1.13	1.73	5.28	6.87	12.15
<u>All</u>	<u>99</u>	<u>1.47</u>	<u>2.86</u>	<u>9.71</u>	<u>16.01</u>	<u>25.72</u>

Table 4.5c: Other results from the analysis at client level for the blended clients.

4.4 Data analysis at therapist level

This section will analyze the data of the institution at the therapist level. Table 4.6a gives an overview of the average annual total treatment times per therapist. There is an increasing trend in the average total treatment time per therapist.

Period	Average total treatment time per therapist (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2008	0.00	1,290.28	1,290.28	0.00	411.21	411.21
2009	0.00	1,511.98	1,511.98	0.00	498.71	498.71
2010	23.62	1,509.97	1,533.59	6.67	515.25	521.92
2011	17.30	775.67	792.97	5.57	279.43	285.00
<u>All</u>	<u>26.97</u>	<u>3,418.97</u>	<u>3,445.94</u>	<u>8.03</u>	<u>1,144.05</u>	<u>1,152.08</u>

Table 4.6a: Average annual treatment times per therapist.

Table 4.6b gives an overview of all the therapists that have treated only f2f in the period that online treatments were available (from 2010). The minimum total treatment time (directly + indirect) for the f2f therapists was 10 minutes and the maximum was equal to 26,167 minutes in 2010.

Period	Average total treatment time per therapist (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2010	0.00	1,411.39	1,411.39	0.00	485.59	485.59
2011	0.00	723.73	723.73	0.00	264.07	264.07
<u>All</u>	<u>0.00</u>	<u>3,162.02</u>	<u>3,162.02</u>	<u>0.00</u>	<u>1,067.36</u>	<u>1,067.36</u>

Table 4.6b: Average annual treatment times per f2f therapist.

Table 4.6c gives an overview of all the therapists that have treated blended (online and f2f). The total online treatment time per therapist was 14% in 2010 and 17% in 2011. The minimum total treatment time for the blended therapists was equal to 1,251 minutes and the maximum was equal to 19,270 minutes in 2010. The average total treatment times (directly + indirect) for the blended therapists are higher than the ones for the f2f clients. In 2010 the average treatment time for the blended therapists were almost 4 times as high as the f2f therapists. This could mean that not all f2f therapists work 40 hours a week with clients with anxiety or addiction disorder. These therapists might be active with many more disorders or have a contract with fewer hours per week than the blended therapists.

Period	Average total treatment time per therapist (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2010	833.38	4,889.76	5,723.14	235.19	1,532.19	1,767.38
2011	385.50	1,881.21	2,266.71	124.21	606.39	730.60
<u>All</u>	<u>857.42</u>	<u>11,329.94</u>	<u>12,187.36</u>	<u>255.06</u>	<u>3,505.09</u>	<u>3,760.15</u>

Table 4.6c: Average annual treatment times per blended therapist.

Tables 4.7 give an overview of the annual income, costs and income/costs per therapist. The income of therapist i is calculated by the following formula:

$$IncomeTherapist(i) = \sum_{j=1}^n \frac{TreatmentTime(i, j)}{TotalTreatmentTimeDTC(j)} \times IncomeDTC(j) \quad (4.1)$$

The costs for therapist i is calculated by using the following formula:

$$CostsTherapist(i) = TotalTreatmenttimeTherapist(i) \times HourlyCostsTherapist(i) \quad (4.2)$$

The income/costs ratio can be calculated by dividing 4.1 with 4.2.

Only contact data of completed DTC's were used for the tables 4.7, because it is not possible to calculate the income and costs per therapist for incomplete DTC's since the total treatment time of the DTC is unknown. There were 31 therapists with unknown details and 14 therapists with an hourly cost equal to 1 euro. A therapist cannot have an hourly cost of 1 euro and therefore it can be concluded that this must be an error. These 45 therapists were excluded for the calculation of the results in tables 4.7. There was a decrease in the average income per therapist of 4.4% and a decrease in the average costs per therapist of 10.1%. This leads to a higher average income/costs per therapist ratio in 2010 (see Table 4.7a).

Period	Average income per therapist (in euro)			Average treatment costs per therapist (in euro)			Average income/costs ratio per therapist		
	Online	F2F	All	Online	F2F	All	Online	F2F	All
2008	0.00	4,368.48	4,368.48	0.00	2,919.21	2,919.21	N/A	1.50	1.50
2009	0.00	4,857.86	4,857.86	0.00	3,525.19	3,525.19	N/A	1.38	1.38
2010	55.68	4,587.10	4,642.78	41.79	3,127.58	3,169.37	1.33	1.47	1.46
2011	13.69	788.18	801.87	11.98	519.57	531.55	1.14	1.52	1.51
All	44.25	10,273.51	10,317.76	33.85	7,107.78	7,141.63	1.31	1.45	1.44

Table 4.7a: Average annual income, treatment costs generated by the therapists and the income/costs ratio.

The tables 4.7b and 4.7c divides the information from table 4.7a in 2 groups: f2f therapists and blended therapists.

Period	Average income per therapist (in euro)			Average treatment costs per therapist (in euro)			Average income/costs ratio per therapist		
	Online	F2F	All	Online	F2F	All	Online	F2F	All
2010	0.00	4,325.00	4,325.00	0.00	2,965.62	2,965.62	N/A	1.46	1.46
2011	0.00	778.71	778.71	0.00	511.50	511.50	N/A	1.52	1.52
All	0.00	9,772.53	9,772.53	0.00	6,804.51	6,804.51	N/A	1.44	1.44

Table 4.7b: Average annual income, treatment costs generated by the therapists and the income/costs ratio of the f2f therapists.

Table 4.7c shows the income, costs and income/costs ratio per therapists of all the therapists in 2010 and 2011 that have treated online and f2f. The average income of the blended therapists was 3.5 times as high as the f2f therapists, while the average costs were 3.3 times as high as the f2f therapists in 2010. The income/costs ratio of the blended therapists was higher than the f2f therapists in 2010, but this ratio becomes lower in 2011. The reason for this could be the fact that therapists with less experience with computers and internet were trained in this year to do online therapies. The ratio for the online contacts is lower in both years compared to the ratio of the f2f contacts.

Period	Average income per therapist (in euro)			Average treatment costs per therapist (in euro)			Average income/costs ratio per therapist		
	Online	F2F	All	Online	F2F	All	Online	F2F	All
2010	1,859.72	13,079.15	14,938.87	1,395.66	8,374.98	9,770.64	1.33	1.56	1.53
2011	403.95	1,058.07	1,462.02	353.30	749.62	1,102.92	1.14	1.41	1.33
All	2,001.99	32,435.92	34,437.91	1,531.08	20,524.12	22,055.20	1.31	1.58	1.56

Table 4.7c: Average annual income, treatment costs generated by the therapists and the income/costs ratio of the blended therapists.

Table 4.8a gives an overview of all other results during the analysis at therapist level. There were only 710 therapists before the implementation of e-mental health in the years 2008 and 2009. In 2010 there were 31 extra therapist included to this group. It is unclear if these therapists were included because of the implementation of e-mental health. The number of therapists has decreased in 2011. The average number of DTC's per therapist has dropped 3.9% from 2009 to 2010. The average number of clients per therapist has dropped with 6.3% during the same period, while the average number of contacts increased with 2.1%. Thus therapists participate in fewer DTC's and treat fewer clients, but have a higher number of contacts. It can be concluded that the fewer DTC's and clients get more treatments.

Period	Nr of therapists	Averages per therapist		Average nr of contacts per therapist		
		Nr of DTC's	Nr of clients	Online	F2F	All
2008	710	6.85	6.54	0.00	39.65	39.65
2009	710	8.44	7.33	0.00	47.29	47.29
2010	741	8.11	6.87	0.82	47.46	48.28
2011	624	5.32	4.87	0.57	25.47	26.04
All	1,049	15.75	12.62	0.92	107.27	108.19

Table 4.8a: Other results from the analysis at therapist level.

The tables 4.8b and 4.8c divides the information from table 4.8a in 2 groups: f2f therapists and blended therapists.

Period	Nr of therapists	Averages per therapist		Average nr of contacts per therapist		
		Nr of DTC's	Nr of clients	Online	F2F	All
2010	720	7.74	6.53	0.00	45.16	45.16
2011	596	5.05	4.62	0.00	24.54	24.54
All	1,016	14.81	11.80	0.00	101.89	101.89

Table 4.8b: Other results from the analysis at therapist level for the f2f therapists.

Only 2.9% of the therapists in 2010 treated blended and 4.7% did that in 2011. There were a total of 33 therapists trained for blended treatments, but there were only 28 in 2011 treating in this way. This could indicate that some of the trained therapists have not started treating online yet or have quit treating online. Blended therapists participate in 2.7 times as much DTC's as the f2f therapists and treat 2.8 times as much clients as the f2f therapists in 2010. The average number of contacts of the blended therapists is 3.4 times that of a f2f therapist in 2010.

Period	Nr of therapists	Averages per therapist		Average nr of contacts per therapist		
		Nr of DTC's	Nr of clients	Online	F2F	All
2010	21	20.76	18.52	28.90	126.38	155.28
2011	28	11.11	10.36	12.64	45.14	57.78
All	33	44.70	37.85	29.12	272.70	301.82

Table 4.8c: Other results from the analysis at therapist level for the blended therapists.

To determine the productivity of therapist one could look at the following KPI's: number of DTC's, number of clients, number of contacts and income/costs ratio. The number of DTC's is not a good KPI, since more than 1 therapist participates in a DTC and not all the therapists have an equal participation rate in these DTC's. The number of clients is not a good KPI, because more than 1 therapist participates in the treatment of a client and the participation rate of all the therapists are not equal here too. The number of contacts is not a good KPI, because not all the therapists work the same amount of hours a week (different contract types) and since the data only contains information about anxiety and addiction disorder it could be that some of the therapists are more active for other types of disorders. The income/costs ratio gives the best indication for the productivity, because the value the therapist creates for the

institution is compared with the costs of the therapist when creating this value. This KPI still has some flaws, because therapists who do good treatments in less time get a lower ratio compared to other therapists in the same DTC who take more time doing treatments of equal value. Perhaps the best KPI for the productivity of a therapist should be a formula with the number of contacts and the total treatment time of that therapist.

4.5 Data analysis at DTC level

This section will analyze the data of the institution at the DTC level. Table 4.9a gives an overview of the average annual total treatment times per DTC. Only data of completed DTC's were used for this analysis.

Period	Average total treatment time per DTC (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2008	0.00	398.46	398.46	0.00	126.91	126.91
2009	0.00	369.16	369.16	0.00	121.76	121.76
2010	6.15	393.42	399.57	1.74	134.25	135.99
2011	6.28	281.41	287.69	2.02	101.38	103.40
All	4.10	519.78	523.88	1.22	173.93	175.15

Table 4.9a: Average annual treatment times per DTC.

The tables 4.9b and 4.9c divides the information from table 4.9a in 2 groups: f2f DTC's and blended DTC's. The minimum total treatment time for the f2f DTC's was equal to 10 minutes and the maximum was equal to 32,618 minutes.

Period	Average total treatment time per DTC (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2010	0.00	395.39	395.39	0.00	135.00	135.00
2011	0.00	283.55	283.55	0.00	101.81	101.81
All	0.00	521.61	521.61	0.00	174.37	174.37

Table 4.9c: Average annual treatment times per f2f DTC.

The average total treatment times needed for blended DTC's was 43.3% higher than the f2f DTC's in 2010 and 37.0% higher in 2011. Thus the blended DTC's requires more treatment time than the f2f DTC's. The minimum total treatment time for the blended DTC's was equal to 15 minutes and the maximum was equal to 3,012 minutes.

Period	Average total treatment time per DTC (in minutes)					
	Directly online	Directly F2F	Directly all	Indirect online	Indirect F2F	Indirect all
2010	273.45	307.91	581.36	77.17	101.55	178.72
2011	156.43	230.01	386.44	50.41	91.10	141.51
All	277.40	398.15	675.55	82.52	144.84	227.36

Table 4.9c: Average annual treatment times per blended DTC.

Table 4.10a gives an overview of all other results during the analysis at DTC level. There are approximately 2,900 DTC's per year for anxiety and addiction disorders. There were 2.2% less DTC's in 2010 compared to 2009. The last row gives the best indication for the average nr of therapists, income, duration and effectiveness per DTC. The duration was calculated by subtracting the first contact date during that period from the last contact date from that period:

$$\text{Duration} = \text{Last contact date} - \text{First contact date} \quad (4.3)$$

The effectiveness was determined by looking at the difference of GAF-score at the beginning and end. The GAF score is a subjective measurement, because it is dependant of the therapist. Different therapists may give different GAF scores to the same client. It would be recommended to use standardized tests to determine the capacity of a client. There are currently these types of measures available at institutions, but that data was not available for this research. It could be assumed that the difference in GAF scores is more objective, because the therapists give the score at the end by comparing the end-state of the client with the beginning-state.

$$\text{Effectiveness} = \text{GAF score at the end} - \text{GAF score at the beginning} \quad (4.4)$$

Only 4,430 of the 6,900 DTC's have GAF scores at the beginning and at the end of the treatment program. Only those DTC's were used to calculate the average effectiveness.

Period	Nr of DTC's	Average per DTC				Average nr of contacts per DTC		
		Nr of therapists	Income (in euro)	Duration (in days)	Effectiveness	Online	F2F	All
2008	2,284	2.11	1,752.73	110.26	2.70	0	12.21	12.21
2009	2,908	2.06	2,044.76	110.18	2.51	0	11.55	11.55
2010	2,844	2.11	2,191.96	111.32	2.89	0.21	12.37	12.58
2011	1,720	1.93	1,782.83	65.07	3.00	0.21	9.24	9.45
All	6,900	2.4	1,747.81	166.03	2.62	0.14	16.31	16.45

Table 4.10a: Other results from the analysis at DTC level.

The tables 4.10b and 4.10c divides the information from table 4.10a in 2 groups: f2f DTC's and blended DTC's.

Period	Nr of DTC's	Average per DTC				Average nr of contacts per DTC		
		Nr of therapists	Income (in euro)	Duration (in days)	Effectiveness	Online	F2F	All
2010	2,780	2.12	2,192.34	110.02	2.82	0	12.47	12.47
2011	1,651	1.94	1,781.00	63.66	2.92	0	9.36	9.36
All	6,798	2.4	1,745.79	165.43	2.59	0	16.39	16.39

Table 4.10b: Other results from the analysis at DTC level for the f2f DTC's

Only 2.3% of the DTC's in 2010 were blended, while 4.0% in 2011 were blended. The duration of blended DTC's is averagely 24.5% higher than the f2f duration of the f2f DTC's. The effectiveness of blended DTC's is 125.87% higher than the f2f DTC's. There were 35.5% less f2f contacts needed for the blended DTC's than the f2f DTC's, but the total number of contacts for the blended DTC's was 40.6% higher than the total number of contacts for the f2f DTC's.

Period	Nr of DTC's	Average per DTC				Average nr of contacts per DTC		
		Nr of therapists	Income (in euro)	Duration (in days)	Effectiveness	Online	F2F	All
2010	64	2	2,175.33	167.88	5.89	9.48	8.05	17.53
2011	69	1.68	1,826.77	98.84	5.00	5.13	6.32	11.45
All	102	2.28	1,882.46	206.00	5.85	9.42	10.55	19.97

Table 4.10c: Other results from the analysis at DTC level for the blended DTC's

This chapter showed all the results of the analysis at contact, contact type, client, therapist and DTC level. The next chapter will discuss the reliability of the data and the bias.

5 Discussion about the data

This chapter will discuss the reliability of the data and the results and conclusions made in the previous chapter. Subsection 5.2 will discuss the bias in the data at the different levels.

5.1 Correctness of the data

Correctness data

During the analysis there were some clear signs of errors in the dataset. There were contacts of the type Internet Therapies online and f2f, which seems to be illogical. Contact types such as Cognitive (behavioral) therapy and Psycho education were always available at the institution, but during the analysis these types of contacts only showed up in 2009-2011. This could only mean that these contact types were named differently in 2008. There were also therapists with an hourly cost of 1 euro per hour. This also indicates an error in the hourly costs.

Standard times

During the analysis of the data it was clear that many therapists use standard treatment times for their therapies. They mostly use 45 minutes for directly treatment time and 15 minutes for indirect treatment time. Because of this the treatment times cannot be correctly analyzed. This might also cause a significant difference between the treatment times of f2f contacts and online contacts. For analysis it is best to use the actual time needed for a certain treatment.

Incompleteness data

There was no information available about certain employees. This made the analysis of the costs and income of these therapists incomplete. Although it is required to keep track of the GAF scores in a DTC, this seems not to be the case in all the DTC's. Some DTC's have only scores in the beginning or the end and others do not have any score at all. This makes the analysis of the effectiveness incomplete.

Smaller n for online contacts

There are only a small proportion of the contacts being performed online compared to the ones performed f2f. This could lead to less reliable results for the treatment times of online contacts. The bigger the n (n is the number of contacts), the more reliable the results become. This is especially the case for the analysis of the treatment times per contact type. The number of contacts of certain types that are treated online are still too small to determine the true average treatment times there.

5.2 Bias in the data

During the whole data analysis it was assumed that all contacts were equal and there were no differences between the contacts. But this is not really the case. Each contact has different background information. There are a client and a therapist present during a contact, the background of the client and therapists should also be taken in consideration. It might be that younger clients require less treatment time per contact than older clients. It could also be that male therapists need more or less time per contact than female therapists. The reason for a certain contact might also be relevant. The DTC's contain information about the diagnosis and tell more about the reason(s) for the contacts. The following subsections will deal with the bias in the data that might be caused by their background.

5.2.1 Client related bias

Table 5.1 gives an overview of the gender of the blended and f2f clients. About 51% of the clients are female and 49% is male for both the blended and f2f clients. The table shows that the genders are equally represented in both groups.

Gender	Nr of clients		Percentage	
	Blended	F2F	Blended	F2F
Female	50	2,198	50.51%	51.02%
Male	49	2,110	49.49%	48.98%
Grand Total	99	4,308	100.00%	100.00%

Table 5.1: Gender of the clients.

Table 5.2 gives an overview of the birth countries of the clients. 89.9% of the blended clients are born in The Netherlands, while only 80.4% of the f2f clients are born in The Netherlands. This could indicate that clients who have a better understanding of the Dutch language are more likely to do online treatments. There are 61 different nationalities for the clients of this institution; the table only contains the nationalities that are treated online and blended. The percentages of the different birth countries show that not all the different birth countries are equally represented in both groups. It could be that clients born in certain countries need more time during therapies; maybe because of a language barrier. It could also be that certain treatment programs are less or more effective for clients born in certain countries.

Birth country	Nr of clients		Percentage	
	Blended	F2F	Blended	F2F
Brazil	1	2	1.01%	0.05%
International area	4	32	4.04%	0.74%
The Netherlands	89	3,463	89.90%	80.39%
Unknown	3	504	3.03%	11.70%
Sri Lanka	1	3	1.01%	0.07%
Turkey	1	103	1.01%	2.39%
Grand Total	99	4,308	100.00%	100.00%

Table 5.2: Birth country of the clients.

Figure 5.3 shows the distribution of the age of f2f and blended clients. Note that the scales of the histograms are not the same. The average age of the f2f clients is 40.7 years and 34.0 years for the blended clients.

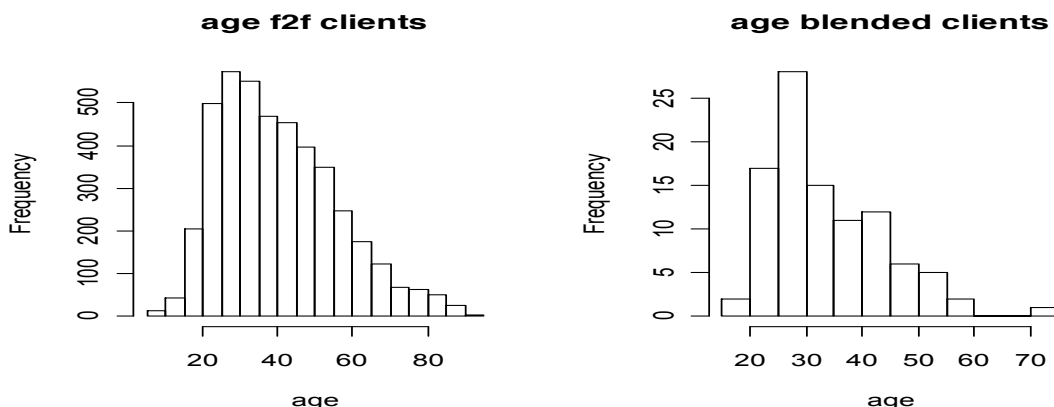


Figure 5.3: Distribution of the age of the clients.

Figure 5.4 gives an overview of the location of the client. Note again that the scales of the different histograms are not the same. Most of the blended clients have a zip code around 7500 and 7700. The f2f clients are also concentrated in this area from 7000 until 8500. One would expect that clients living far away from the institution would be the ones treated blended, but in reality this is not the case.

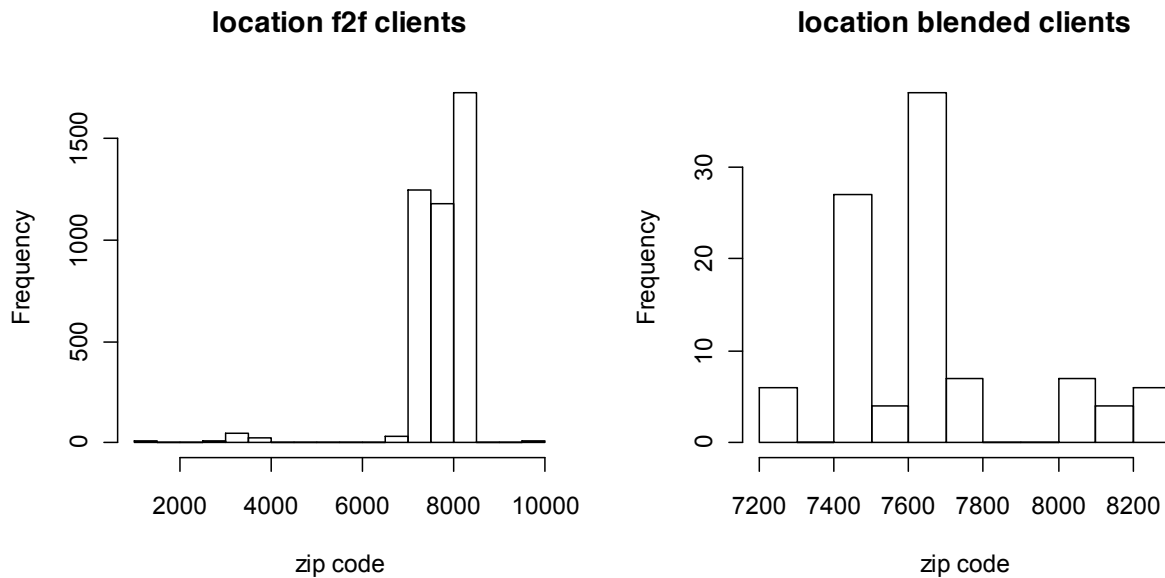


Figure 5.4: Distribution of the zip code of the clients.

5.2.2 Therapist related bias

Table 5.5 gives an overview of the gender of the blended and f2f therapists. About 82% of the blended therapists are female, while only 67% of the f2f therapists are female. The table could indicate that it is more likely that a female therapist might do online treatments. The table shows that the genders are not equally represented in both groups.

Gender	Nr of therapists		Percentage	
	Blended	F2F	Blended	F2F
Female	27	684	82%	67%
Male	6	301	18%	30%
Grand Total	33	1,016	100%	100%

Table 5.5: Gender of the therapists.

Table 5.6 gives an overview of the specialization of the therapists. Most of the therapists that treat online are either GZ-psychologist (45% blended vs. 10% f2f) or psychologist with no further specialization (39% blended vs. 6% f2f). The specializations are also not equally represented in both groups. There are 26 different types of specializations of which only 5 do online treatments. The table gives an overview of only these types of therapists. The

specializations that do not treat online are shown in Appendix E. This could explain the lower total treatment times and number of contacts per f2f therapist. Most of the f2f therapists do not work only with clients with anxiety and addiction disorders, but they also treat clients with other disorders. This has a negative influence on the results found at therapist level.

Specialization	Nr of therapists		Percentage	
	Blended	F2F	Blended	F2F
Mental health nurse specialist	2	38	6.06%	3.74%
GZ-psychologist	15	103	45.45%	10.14%
Clinical psychologist	1	28	3.03%	2.76%
Psychologist (no further specialization)	13	64	39.39%	6.30%
Nurse(art.3)	2	260	6.06%	25.59%
Grand Total	33	1,016	100.00%	100.00%

Table 5.6: Specialization of the therapists.

Figure 5.7 shows the distribution of the age of the f2f and blended therapists. Note that the scales of the histograms are not the same. The average age of the f2f therapist is 44.6 years and 34.6 years for the blended therapists. Thus the blended therapists are averagely 10 years younger than the f2f therapists. This could also have an impact on the results found at therapist level, because it could be that older therapists need more time to treat clients. Younger inexperienced therapists might need more time to treat certain clients compared to the older more routine therapists.

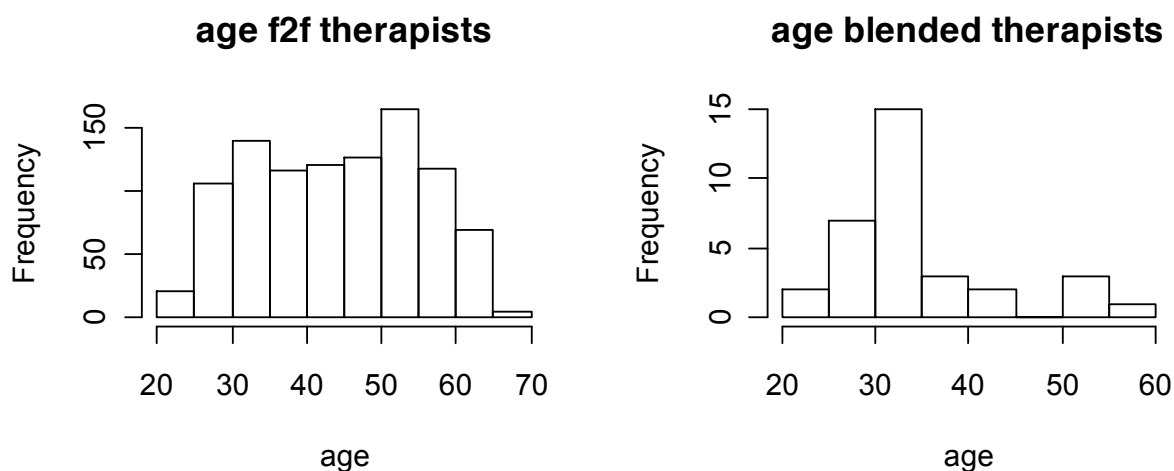


Figure 5.7: Distribution of the age of the therapists.

Figure 5.8 shows the distribution of the hourly costs of the f2f and blended therapists. Note that the scales of the histograms are also not the same here. The average hourly cost for the f2f therapist is 101.13 euro (the incorrect values were excluded) and 97.44 euro for the blended therapists.

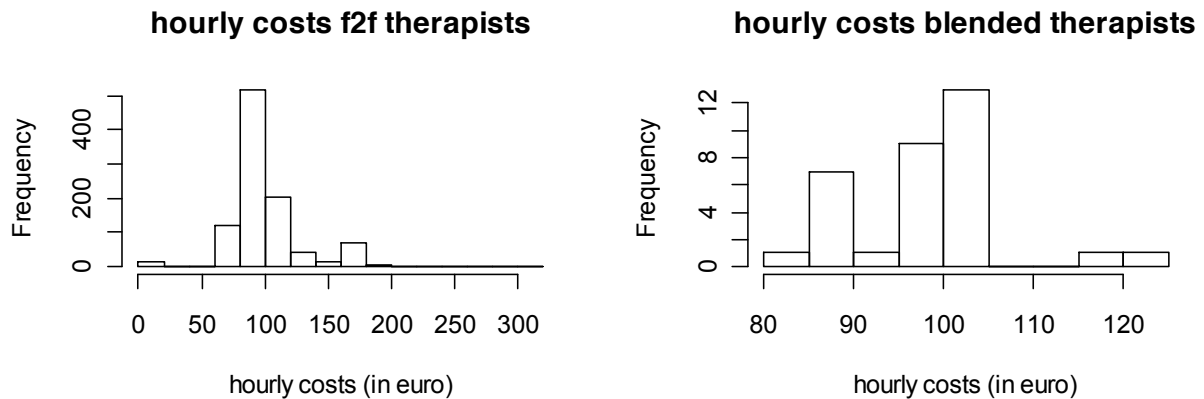


Figure 5.8: Distribution of the hourly costs of the therapists.

5.2.3 DTC related bias

Table 5.9 gives an overview of the main diagnosis of the DTC's. It shows that there was only 1 DTC for addiction disorders treated blended. This is about 1% of all the blended DTC's, but 36% of the f2f DTC's were for addiction disorders. The treatment times for addiction care have a bigger influence on the f2f treatment times than for the blended treatment times.

Diagnosis	Nr of DTC's		Percentage	
	Blended	F2F	Blended	F2F
Addiction	1	2,416	0.98%	35.54%
Anxiety disorder	101	4,382	99.02%	64.46%
Grand Total	102	6,798	100.00%	100.00%

Table 5.9: Main diagnosis of the DTC's.

There are 41 different DSM IV – codes of which only 7 are treated online. Table 5.10 shows an overview of these 7 DSM IV – codes. Not all the DSM IV – codes are equally represented in both groups. This could also influence the results found in the previous chapter, because it could be the case that some DSM IV – codes represent more severe disorders, which could indicate that more treatment and contacts are needed for these clients.

DSM IV - code	Nr of DTC's		Percentage	
	Blended	F2F	Blended	F2F
300.01	5	636	4.90%	9.36%
300.02	18	1,166	17.65%	17.15%
300.21	43	1,308	42.16%	19.24%
300.22	1	44	0.98%	0.65%
300.23	25	991	24.51%	14.58%
300.29	9	232	8.82%	3.41%
303.90	1	945	0.98%	13.90%
Grand Total	102	6,798	100.00%	100.00%

Table 5.10: DSM IV – codes of the DTC's.

Figure 5.11 shows the distribution of the income of the f2f and blended DTC's. Note that the scales of the histograms are not the same. The average income for the f2f DTC's is 1745.79

euro and 1882.46 euro for the blended DTC's. This could have influenced the results found for the income per therapist and the income/costs ratio of the therapists.

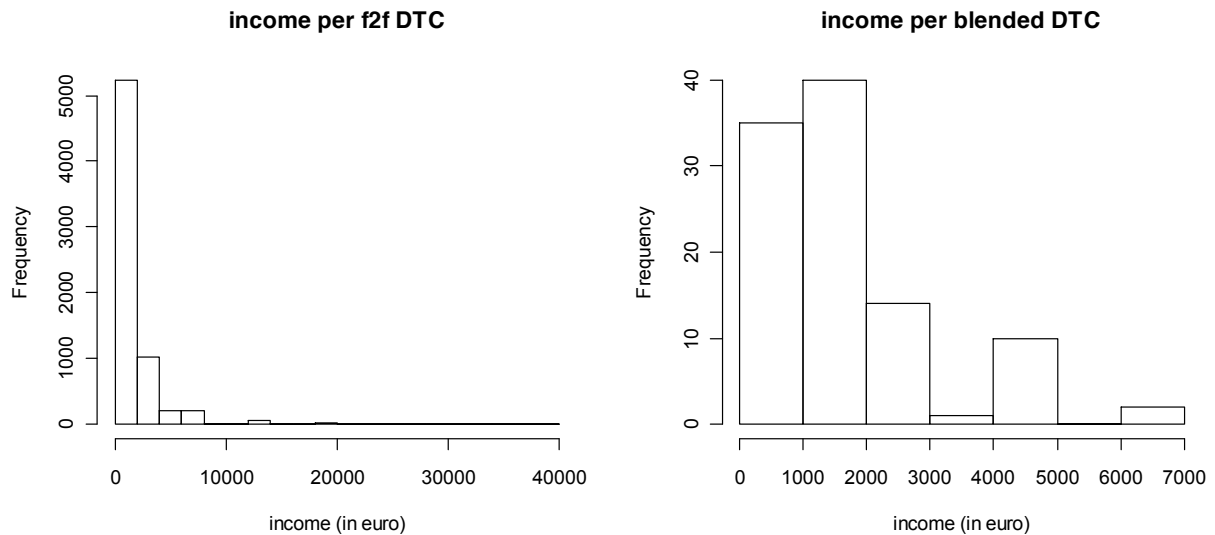


Figure 5.11: Distribution of the income of the DTC's.

Figure 5.12 shows the distribution of the GAF scores (at the beginning of the DTC's) for the f2f and blended DTC's. Note that the scales of the histograms are also not the same here. The average GAF score for the f2f DTC's is 56.45 and 60.23 for the blended DTC's. The histogram for the f2f DTC's looks normally distributed, while the lowest GAF score of the blended DTC's is 50. This shows that there is a strict selection procedure for the blended treatments within the institution. The institution clearly thinks that a client with a GAF score below 50 is not suitable for online treatments. The effectiveness of the blended treatments was shown to be more than twice the effectiveness of the f2f treatments. *But does it mean that it takes the same amount of effort to improve the GAF score from 20 to 30 or from 70 to 80?* Riper et al (2007) mentions that a higher effectiveness for mental health disorders can be achieved by prevention and early treatments. The GAF scores in the case of prevention and early treatments are more likely to be higher than when a disorder becomes more severe. It is also mentioned that prevention and early detection can over time lead to a reduction of the number of intensive treatments in specialized secondary care and more efficient use of the resources within this line, for clients who really need care. Thus it can be said that there is much more effort needed to get a client with GAF score of 10 to 20 than a client with GAF score from 70 to 80. It is easier to prevent a disorder. If you identify a disorder early there is a bigger chance of healing or minimizing the impact it can have on your life.

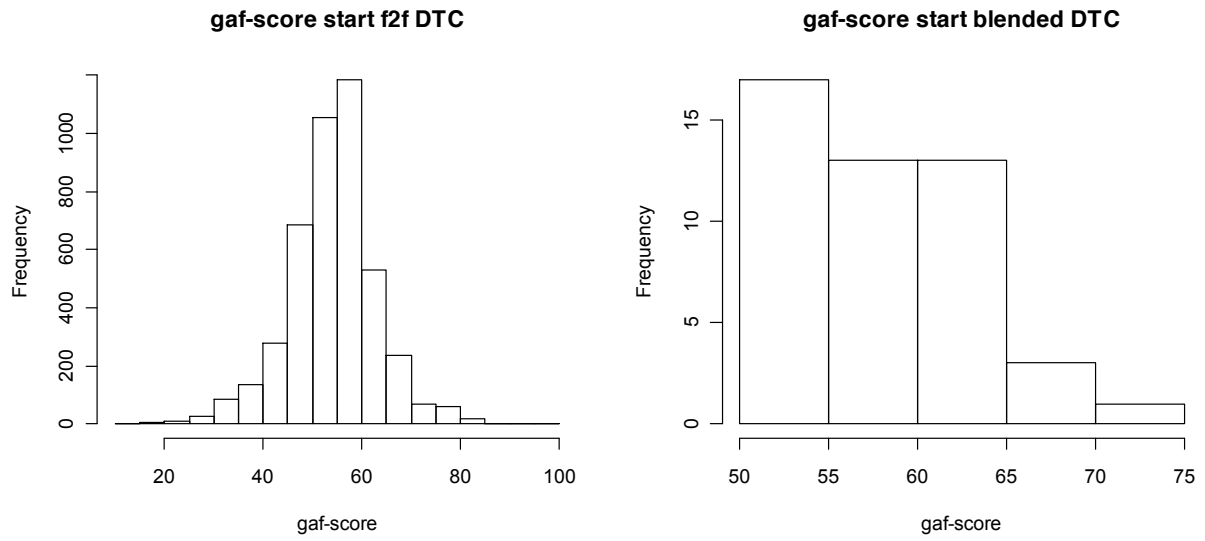


Figure 5.12: Distribution of the GAF score at the beginning of the DTC's.

6 Conclusion

This chapter gives the conclusion, discussion and recommendations regarding this research.

6.1 Conclusion

The purpose of this thesis was to determine the impact of e-mental health on the mental health and addiction care processes in terms of efficiency and effectiveness. The following KPI's were defined for this research:

- KPI's for efficiency: treatment times, number of contacts, duration and productivity.
- KPI for effectiveness: effectiveness.

The average treatment time of online contacts is 10% less than the average treatment time for the f2f contacts. This difference becomes even greater when looking at the different possible types of contacts separately. E-mental health reduces the average treatment times of cognitive behavioral therapy with 29%, individual psycho therapy with 3%, intake with 51%, psycho-education 24%, supportive and structural therapy with 32%. However, the numbers of online contacts of most of these types are still very low, which causes statistical uncertainties. There are also many different types of contacts that are only done f2f. Thus, there is room for improvements. The institutions should do research to find out which of these types of contacts could also be done online.

The blended treatment programs contain f2f and online contacts, while the f2f treatment programs contain only f2f contacts. The average number of f2f contacts per blended treatment program is 36% less than the average number of f2f contacts for the f2f treatment programs. These f2f contacts are very costly compared to the online contacts because of higher treatment times, traveling costs, costs for using a room for the f2f meeting, etc. The average number of contacts (online + f2f) per blended treatment program is 22% more than the average number of contacts per f2f treatment program. Thus, it can be said that clients get attention more frequently from their therapists when they are treated blended.

The average duration of the blended treatment programs is 25% longer than the average duration of the f2f treatment programs. Thus, the institutions get paid later for their given services, because institutions get paid only for completed treatment programs.

The average productivity of the therapists that treat blended is 9% higher than the average productivity of the therapists that treat only f2f. The productivity is the income/costs ratio of a therapist. Thus, the therapists generate more income for the institution per working hour when they are treating blended. The average number of contacts, clients, DTC's per therapist is also higher in for blended therapists, but there are many therapists that also treat clients with other disorders than anxiety or addiction. It would be better to analyze all the treatments the therapists perform (also other disorders), to get a better understanding of the impact e-mental health has on the productivity.

The average effectiveness of the blended treatments is 126% higher than the average effectiveness of the f2f treatments. This effectiveness is the change in GAF score during a completed treatment program (from the beginning to the end). Thus, the mental progress made by the clients is more than twice as high when the clients are treated blended.

6.2 Discussion

The main problem of this research is that the analyzed data is biased. Each contact type has background information about the client, therapist, DTC, contact-type, etc. This bias is caused by the fact that clients that are treated blended have not been randomly chosen.

Randomized controlled trials will offer more reliable results. The institutions will have to randomly select therapists to do online therapies and clients that should be given online treatments. The impact of the background information of each contact type will be reduced by doing so. Such randomized controlled trials should also be performed at other institutions to determine the impact the use of the online treatment center of Minddistrict has on the KPI's there. The results found for one institution does not have to be representative for all the institutions. It would also be interesting to know what the impact of the online treatment centers of other e-mental health providers are. The results found for one e-mental health provider does not have to be representative for all the e-mental health providers. Randomized controlled trials with the online treatment center of other e-mental health providers would give a good indication of the impact of e-mental health.

Are the results found representative for foreign institutions? Minddistrict has the ambition to grow abroad. Will the online treatment center have the same impact there or do they have different procedures and legislations there, which will make the implementation less successful?

Since the GAF score is a subjective measure it would be advised to use other standardized tests to determine the functioning of a client or the severity of a disorder. The effectiveness of treatments can be identified better by using standardized methods to determine the severity of different types of disorders.

There were many KPI's analyzed for this research. It is important to decrease the number of KPI's, since keeping track of too many KPI's may cost too much time and effort. E-mental health providers and the institutions should identify the most important KPI's. A maximum of 3 KPI's is recommended. The most important KPI is the average effectiveness, since this KPI is most relevant for the quality of the service perceived by the clients. The average treatment times and average number of contacts are good KPI's to measure the impact of e-mental health on the mental health processes in terms of efficiency.

6.3 Recommendations

There were many ideas during the internship, which could not be performed because there was not enough time left to do all those researches. Here are some recommendations for future research:

1. Repeat this research, but only select those f2f contacts that have similar background variables by using data mining techniques. This research will give better results, because the bias will be reduced.
2. Randomized controlled trials, with two randomly selected groups therapists (blended and f2f) and two randomly selected groups clients (blended and f2f), for the different contact types to determine which types of contacts are most beneficial to be performed online.
3. Randomized controlled trials for clients with a GAF score lower than 50, with two randomly selected groups clients (blended and f2f), to determine the lower bound for the GAF scores that can be treated online.

4. A complete analysis of the costs of f2f contacts and online contacts. Costs for using a room for therapy, traveling expenses for the therapists, etc. should be added to the costs for the f2f treatments and costs for firewall, virus scanner, other software, other software, training for online treatments, larger IT-department should be added to the costs for the online treatments.
5. Determine the impact of e-mental health on the no-shows and waiting times for the clients that are treated f2f and blended.
6. Determine the client satisfaction for the online treatment center by doing surveys.
7. Perform recommendations 1-6 for other institutions that are customers of Minddistrict and compare the results with each other.
8. Perform recommendations 1-6 for other e-mental health providers than Minddistrict and compare the results with each other.
9. Perform recommendations 1-6 for institutions abroad.

There were also some difficulties during this research. Here are some recommendations for the institutions to make it easier for future research in this area:

1. Try to save data as correct as possible, because there are no good conclusions possible with wrong data.
2. Accelerated procedures for participation in research studies. Institutions were asked to participate in this research in February, but it took too much time to get permission from the boards of the institutions. The first complete dataset was received on the 14th June; the second dataset was received on 12th of July. It would be beneficial for both parties (the institutions and the researchers) if there would be an accelerated procedure for permission to participate in certain researches.
3. Help set up randomized controlled trials to get better results regarding the impact of e-mental health (see recommendations for future research).
4. Try to stimulate more use of online treatments.
5. Experiment with therapists doing treatments from their home.
6. Lean thinking: instead of telling the therapists to use online therapies, the institutions could present e-mental health as a tool and give the therapists the space to decide how e-mental health could benefit them in treating their clients. Therapists should be more involved in the decision making during the change.

Appendix

A Normality of the treatment times

For the usage of the t-test to determine if there is a significant difference between the online and f2f treatment times, the treatment times need to be normally distributed. The histograms and QQ-plots of the treatment times were used to determine if they were normally distributed.

A.1 Histograms of the treatment times

Figure A.1 shows the distribution of the directly and indirect treatment times f2f and online. Note that the scales are not the same for the f2f and the online treatment times. The histograms show that the treatment times are not normally distributed.

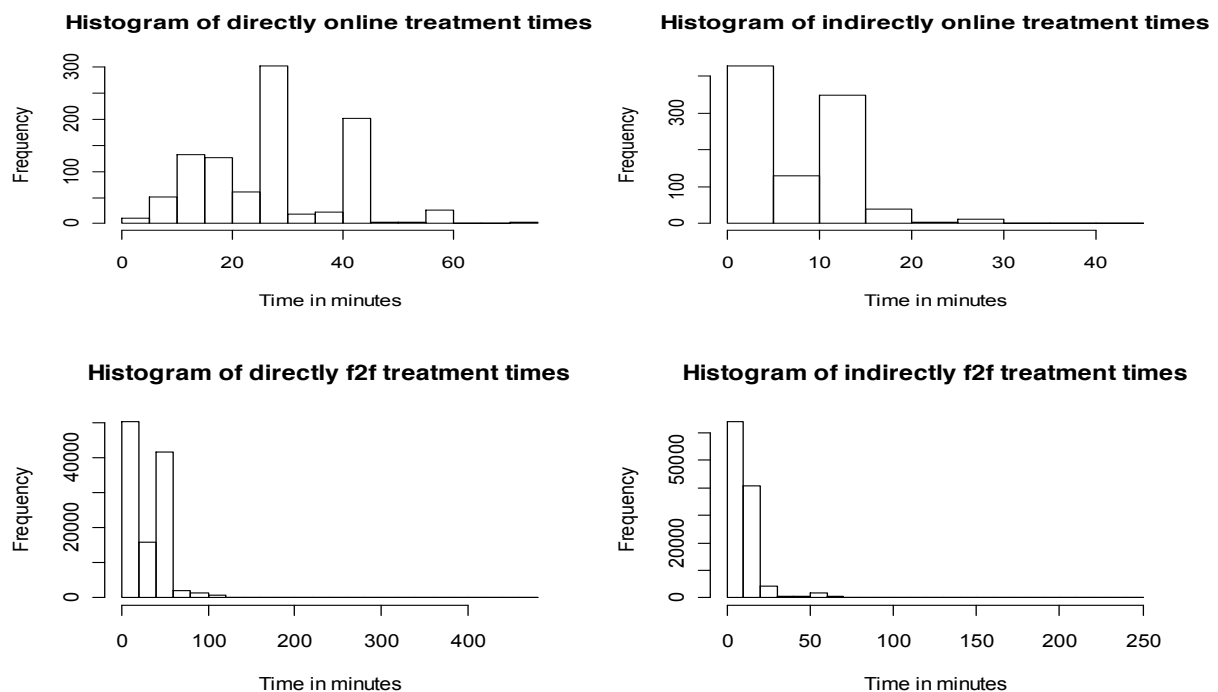


Figure A.1: Histograms of the treatment times. The treatment times are clearly not normally distributed. Thus the t-test will not work properly on these datasets.

A.2 QQ-plots of the treatment times

Figure A.2 shows the QQ-plots of the directly and indirect treatment times f2f and online. The QQ-plots also show that the treatment times are not normally distributed.

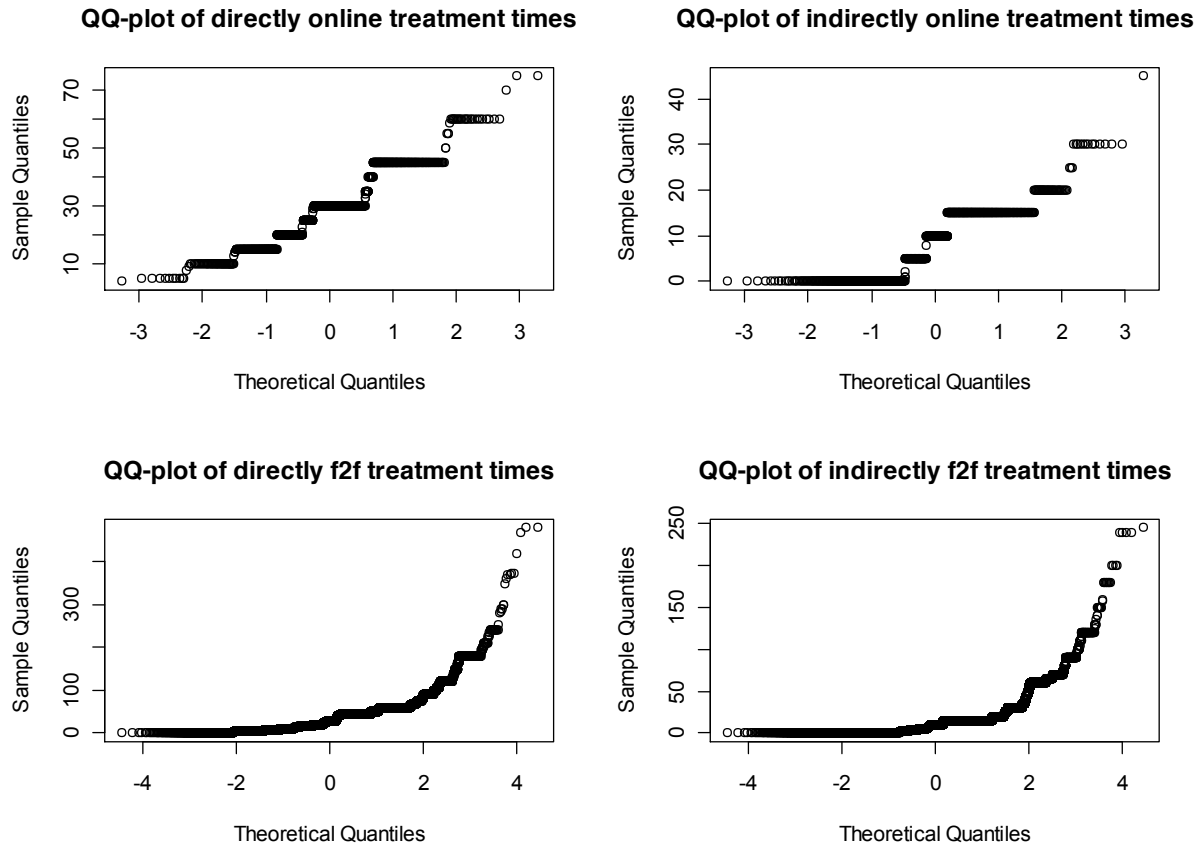


Figure A.2: QQ-plot of the treatment times put out against the quantiles of the normal distribution. The treatment times are clearly not normally distributed, because the Q-Q-plots don't show straight lines.

B Significance difference treatment times online vs. f2f

The Wilcoxon test and 95% bootstrap confidence intervals will be used to determine if the differences between the average treatment times online and f2f are significant.

B.1 Results Wilcoxon test

The hypotheses below were tested using the Wilcoxon test. The null hypothesis will be rejected when the p-value is lower than $\alpha=0.05$.

1. H_0 : directly treatment times online in 2010 is greater than the directly treatment times f2f in 2010 \rightarrow P-value = 0.1704.
2. H_0 : indirect treatment times online in 2010 is greater than the indirect treatment times f2f in 2010 \rightarrow P-value = 2.405e-12.
3. H_0 : directly treatment times f2f in 2011 is greater than the directly treatment times f2f in 2011 \rightarrow P-value = 0.01582.
4. H_0 : indirect treatment times online in 2010 is greater than the indirect treatment times f2f in 2010 \rightarrow P-value = 0.2820.

The p-value is lower than α in case 2 and 3, which leads to the rejection of the null hypothesis there. Thus it can be said that:

- Indirect treatment times online in 2010 \leq indirect treatment times f2f in 2010.
- Directly treatment times f2f in 2011 \leq directly treatment times online in 2011.

B.2 Results 95% bootstrap confidence intervals

The tables B.1 and B.2 contain the 95% bootstrap confidence interval of respectively the directly and indirect treatment times.

Year	Directly treatment times 95% confidence intervals			
	Online		F2F	
	2.50%	97.50%	2.50%	97.50%
2010	27.83	29.78	31.58	32.05
2011	29.19	31.74	30.12	30.79

Table B.1: 95% confidence intervals for the directly treatment times.

Table B1 shows that the confidence interval of the f2f treatments in 2011 lies within the confidence interval of the online treatments in 2011. But in Appendix B.1 (case 3) the Wilcoxon test showed that the difference between the f2f and the online contacts appear to be significant. The table also shows that the confidence interval of the directly online treatment times in 2010 is below the interval of the f2f treatment times, thus the following can be concluded:

- Directly treatment times online in 2010 \leq directly treatment times f2f in 2010.

Year	Indirect treatment times 95% confidence intervals			
	Online		F2F	
	2.50%	97.50%	2.50%	97.50%
2010	7.58	8.68	10.75	10.97
2011	9.08	10.50	10.81	11.13

Table B.2: 95% confidence intervals for the indirect treatment times.

Table B.2 clearly shows that the 95% confidence intervals of the indirect online treatment times are below the intervals of the f2f contacts. Thus, it can be concluded that:

- Indirect treatment times online \leq indirect treatment times f2f in 2010 and 2011.

C Overview non-online contact types

Table C.1 gives an overview of the contact types that do not take place online. The second column shows the volume of that type of contact. The third column shows the amount of DTC's in which such a type of contact took place. The fourth and fifth column show the nr of therapists and clients that use such a type of contact. The last two columns show the average directly and indirect treatment times of each contact type.

Contact type	Nr of contacts	Nr of DTC's	Nr of therapists	Nr of clients	Average treatment times	
					Directly	Indirect
OVERDUE REGISTRATION	313	97	78	96	29.70	6.69
Treatment guidance (conv)	819	252	134	248	35.29	13.22
Conversion intending	227	25	11	22	47.17	10.75
Outpatient conversion	17,075	1,385	397	1073	35.60	11.94
Creative therapy	221	14	10	10	18.47	4.13
Crisis Intervention	1,261	504	177	410	57.20	25.56
Day activities	4	3	3	2	18.75	10.00
Part-time treatment	8,713	30	76	26	7.44	0.38
EMDR	231	69	36	62	64.50	12.86
Occupational Therapy	18	3	1	3	46.94	15.56
Pharmacotherapy	2,260	600	138	393	22.79	10.25
Physiotherapy	2	2	1	2	17.50	27.50
Mental health consultation	540	285	51	282	50.96	20.26
Group treatment	10,354	297	209	234	13.16	3.43
Group psychotherapy	2,574	112	72	87	17.68	4.19
Intensive psych. family care	1	1	1	1	30.00	15.00
Interpersonal therapy	9	2	2	2	45.00	15.00
Metallization Based Therapy (MBT)	187	4	8	2	19.42	6.42
Secondary contact	144	35	37	33	27.22	6.17
Prevention group	8	3	2	2	60.00	3.75
Prevention individual	5	3	2	2	24.00	9.00
Psychiatric int. home care	334	37	23	27	48.95	13.49
Psychomotor therapy (PMT)	229	30	12	22	28.50	8.72
Scheme cogn. behavioral therapy	170	29	11	23	44.59	12.44
Screening	15	9	10	8	30.00	13.67
Social psychiatric guidance	565	64	45	39	36.32	11.21
System psychotherapy	31	5	5	4	46.77	13.87
System treatment	205	45	25	42	40.12	7.04
Phone in prescription	4	2	3	2	28.75	16.25
Skills training	402	30	10	27	19.70	1.90
VERS	125	4	2	3	22.84	3.08
Work-oriented counseling	344	49	13	29	35.77	14.07

Table C.1: Overview of the non online contact types.

D Ceteris paribus principle

In this section the ceteris paribus principle will be applied on the treatment times of the cognitive (behavioral) therapy and the psycho education.

D.1 Cognitive (behavioral) therapy

Figure D.1 shows the histograms of the directly treatment times for cognitive (behavioral) therapy. The average directly treatment times of all the contacts (online and f2f together) from 2009, 2010 and 2011 are respectively 37.69, 39.78 and 44.11 minutes.

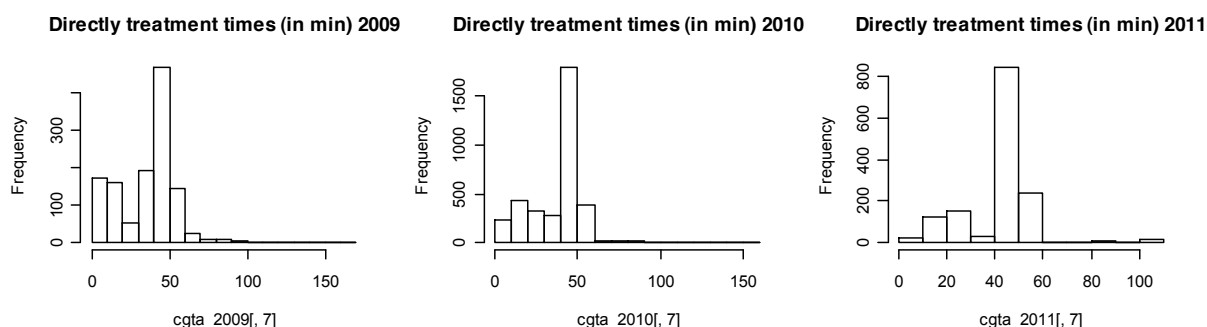


Figure D.1: Histogram of the directly treatment times (online+f2f) of contact type cognitive behavioral therapy.

Figure D.2 shows the histograms of the indirect treatment times for cognitive (behavioral) therapy. The average indirect treatment times of all the contacts (online and f2f together) from 2009, 2010 and 2011 are respectively 12.45, 11.79 and 12.90 minutes.

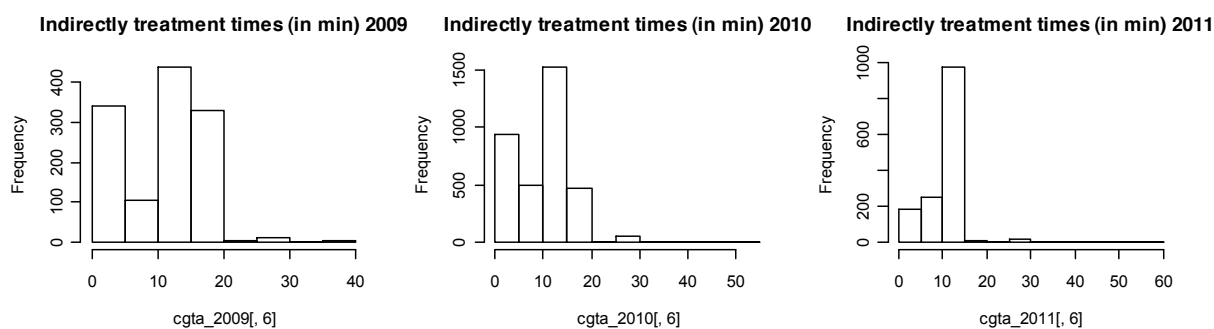


Figure D.2: Histogram of the indirect treatment times (online+f2f) of contact type cognitive (behavioral) therapy.

Table D.3 gives an overview of the number of contacts of type cognitive (behavioral) therapy that took place annually and the annual average treatment times online and f2f. The table shows that the average treatment times for the online contacts are lower than for the f2f contacts for this contact type.

Period	Program type	Nr of contacts		Average treatment times (in minutes) per program type			
		Online	F2F	Directly online	Directly F2F	Indirect online	Indirect F2F
2009	Cognitive (behavioral) therapy	0	1,232	N/A	37.69	N/A	12.45
2010	Cognitive (behavioral) therapy	512	2,978	29.69	41.51	7.85	12.46
2011	Cognitive (behavioral) therapy	188	1,257	31.69	45.97	10.57	13.25

Table D.3: The annual number of contacts of cognitive (behavioral) therapy and the average treatment time per contact type online and f2f separately.

D.1 Psycho education

Figure D.4 shows the histograms of the directly treatment times for psycho education. The average directly treatment times of all the contacts (online and f2f together) from 2009, 2010 and 2011 are respectively 35.57, 25.42 and 27.30 minutes.

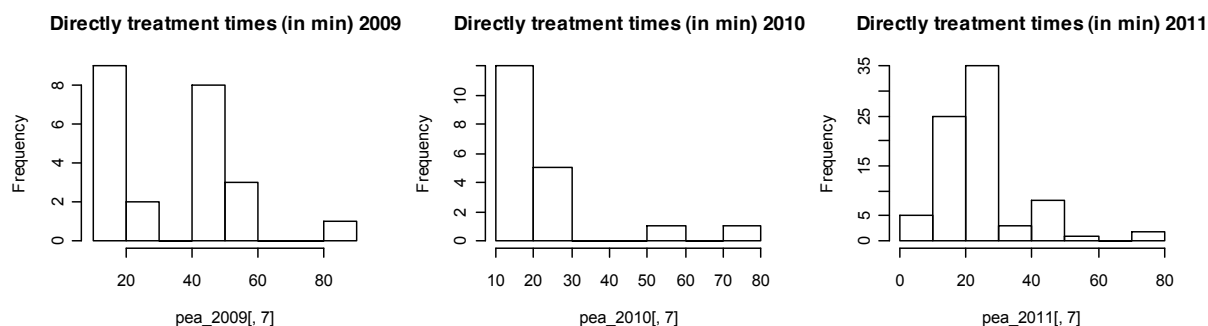


Figure D.4: Histogram of the directly treatment times (online+f2f) of contact psycho education.

Figure D.5 shows the histograms of the indirect treatment times for psycho education. The average indirect treatment times of all the contacts (online and f2f together) from 2009, 2010 and 2011 are respectively 10.39, 10.00 and 10.08 minutes.

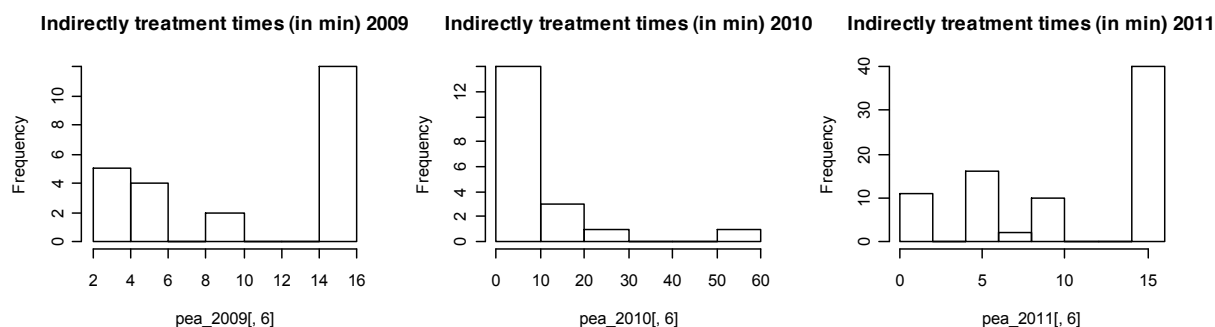


Figure D.5: Histogram of the indirect treatment times (online+ f2f) of contact psycho education.

Table D.6 gives an overview of the number of contacts of type psycho education that took place annually and the annual average treatment times online and f2f. The table shows that the average treatment times for the online contacts are lower than for the f2f contacts for this contact type.

Period	Program type	Nr of contacts		Average treatment times (in minute) per program type			
		Online	F2F	Directly online	Directly F2F	Indirect online	Indirect F2F
2009	Psycho education	0	23	N/A	35.57	N/A	10.39
2010	Psycho education	5	14	22.80	26.36	8.20	10.64
2011	Psycho education	50	29	24.16	32.72	9.20	11.59

Table D.6: The annual number of contacts of cognitive (behavioral) therapy and the average treatment time per contact type online and f2f separately.

E Overview non-online specializations

Table E.1 gives an overview of the specializations that do not treat online. The first column gives the name of these specializations, the second column the number of therapists with that type of specialization and the last column the percentage this specialization has in the whole f2f therapists group. The f2f specialists of Table 5.6 should be added to this table to add up to 100%.

Specialization	Nr of therapists	Percentage
Doctor (including Premiums / Agnio)	83	8.17%
Doctor on addiction	3	0.30%
Dietician	1	0.10%
Physiotherapist	1	0.10%
Mental health therapists	31	3.05%
GZ therapists	1	0.10%
General practitioner	3	0.30%
Clinically geriatrician	1	0.10%
Social worker	39	3.84%
Neurologist	1	0.10%
Other field therapeutic SF	5	0.49%
Other nursing SF	1	0.10%
Educator (including remedial)	3	0.30%
Psychiatrist	80	7.87%
Psychotherapist	33	3.25%
Social geriatrician	4	0.39%
Social pedagogical helper	42	4.13%
Social psych. nurse	127	12.50%
Creative therapists	13	1.28%
Therapists psychomotor	20	1.97%
Unknown	31	3.05%
Grand Total	1,016	100.00%

Table E.1: Overview of the specializations that do not treat online.

F Overview non-online DSM IV – codes

Table F.1 gives an overview of the DSM IV – codes that do not treat online. The first column gives the code, the second column the number of DTC's with that code and the last column the percentage this code has in the whole f2f DTC's group. The f2f DTC's of Table 5.10 should be added to this table to add up to 100%.

DSM IV - code	Nr of DTC's	Percentage
291.1	68	1.00%
291.2	17	0.25%
291.3	6	0.09%
291.5	4	0.06%
291.8	1	0.01%
291.89	11	0.16%
291.9	22	0.32%
292.0	6	0.09%
292.11	38	0.56%
292.12	14	0.21%
292.81	3	0.04%
292.82	1	0.01%
292.83	1	0.01%
292.84	15	0.22%
292.89	19	0.28%
292.9	19	0.28%
303.00	11	0.16%
304.00	39	0.57%
304.10	96	1.41%
304.20	59	0.87%
304.30	358	5.27%
304.40	38	0.56%
304.60	5	0.07%
304.80	205	3.02%
304.90	21	0.31%
305.00	287	4.22%
305.10	4	0.06%
305.20	51	0.75%
305.30	1	0.01%
305.40	2	0.03%
305.50	1	0.01%
305.60	23	0.34%
305.70	15	0.22%
305.90	15	0.22%
Grand Total	6,798	100.00%

Table F.1: Overview of the DSM IV codes that are not treated online.

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